PHD

THE IMPACTS OF CREDIT DEFAULT SWAPS ON DEBT PRICING, CORPORATE INVESTMENT AND DIVIDEND POLICY

Wu, Yulin

Award date:
2018

Awarding institution:
University of Bath

THE IMPACTS OF CREDIT DEFAULT SWAPS ON DEBT PRICING, CORPORATE INVESTMENT AND DIVIDEND POLICY

YULIN WU

Thesis submit to the University of Bath

for the degree of Doctor of Philosophy

October 2018

Abstract

This thesis seeks to answer how the availability of credit default swaps (CDSs) affects the economy and its participants. As a sort of financial innovation, CDSs transfer default risk among investors. For each transaction, the CDS buyer pays the seller a premium and, in exchange, receives compensation if a specified credit event happens. In the process, the risk taker has been changed. This alteration subtly affects the incentives of creditors and borrowers and the underlying economic logic merits better understanding.

Our research firstly explores the impact of credit default swaps on the yield spread between corporate and Treasury bonds. Since CDSs can affect debt pricing in both negative and positive ways, we attempt to separate these two opposite forces. Using both theoretical and empirical approaches, we show how firm-specific CDSs affect the yield spread under different bond issuing conditions. Specifically, we find that the aggregate CDS effect depends on firms' credit strengths when bonds are issued and the yield spread shrinks (expands), after the start of CDS trading, with good (poor) firm credit.

The second motivation of this thesis is to investigate changes in a firm's investment and its investment-cash flow sensitivity following the introduction of CDS trading. We find that reference firms reduce their investments, on average, after introducing credit default swaps and their investment-cash flow sensitivities increase simultaneously. However, these effects are dependent on firms' qualities. For firms with high liquidity or integrity, investments are increased and they rely less on cash flows while firms with

low liquidity or integrity cut down investments and exhibit higher dependence.

Finally, we extend our research to the CDS effects on corporate dividend policy, the signaling role of dividends and stock responses to dividend announcements. As vehicles for transferring risk, CDSs weaken third-party protection for minority shareholders. This, in turn, can affect managers' incentives and the setting of dividend policy. We find that firms are more likely to pay, increase and continue to pay dividends after their debts are referenced by CDSs especially for firms with higher free cash flows, older firms and larger firms. The connotation changes too: the relationship between dividends and future earnings growth is weakened following the initiation of a CDS market.

Acknowledgements

I would like, first and foremost, to express my sincere gratitude to my supervisor, Professor David Newton, for his meaningful enlightenment, promotion and instruction throughout my PhD phase. Every discussion with him has given me valuable suggestions contributing to the completion of this work. I really appreciate his patience, encouragement and understanding on my journey towards a doctorate. He is not just a supervisor for me but acts as a family member somehow. I am very honored to be one of "The Newton Group". My thanks go to Dr Ru Xie and Dr Le Hang for their highly discerning and beneficial comments on this thesis.

I dedicate this thesis to my parents, Junhang Wu and Qing Yang, for their selfless love and attention. Without their unconditional support, I could not overcome challenges in my life and make my dream come true. They provide me the faith that I can be better and help me step by step to be better. I also want to show my appreciation to Yang Cheng, who always stands by me sharing happiness and difficulty. Your love and understanding make us with one heart and one mind through any kind of weather.

I would like to take this opportunity to thank my friends in the Bath University Management School and the Nottingham University Business School for their great help and insightful advice. I appreciate experiencing such a wonderful "adventure journey" with you in my life and it will be my most precious memory. In particular, I want to thank Hui Tian, Qi Hu, Haozhe Su, Zichen Yu and Kai Yao, who give inspiration, motivation and suggestions, and unreservedly help me in many ways. Additionally, I would like to show my gratitude and respect to all other members of staff and colleagues

helping me to finish this thesis.

The process of my PhD study is a narrative about growing up. It not only enables me to know how to carry out independent research, but also teaches me how to face tough things and defeat them. I will engrave this invaluable lesson on my mind and keep this indomitable spirit for the rest of my life.

Table of Contents

List of Tables

List of Figures

Abbreviations

ADR	America Deposit Receipt
CDS	Credit Default Swaps
CF	Cash Flows
EPS	Earnings Per Share
FICO	Fair Isaac Corporation
FISD	Fixed Investment Securities Database
GMM	Generalized Method of Moments
IBM	International Business Machines Corporation
IFRS	International Financial Reporting Standards
ISS	Institutional Shareholder Services
LIBOR	London Interbank Offered Rate
MBS	Mortgage-backed Securities
MV	Market Value of Equity
NI	Net Income
NPV	Net Present Value
OLS	Ordinary Least Squares
PPENT	Property, Plant and Equipment
Q	Tobin's Q
RE	Retained Earnings
ROA	Return on Assets
ROE	Return on Equity
SHO	Common Shares Outstanding
S&P	Standard and Poor's
US	United States

Chapter 1

Introduction

1.1 Background and Motivation

The basic mechanism between creditor and debtor is performed in a simple way: one party supplies capital and holds risk while the other (the counterparty) conducts business and pays a stipulated return. Under this framework, a creditor cannot separate beneficial right from risk exposure, and this contributes to the creditor's interest in monitoring and the legal protection for him in the event of financial distress. However, this may not optimal for both sides. From a creditor's perspective, lending is costly due to ex post supervisions, capital requirements and expenses if there is a debt renegotiation or a court case. On the other hand, a debtor may find it hard to raise external funds and these are also more expensive than internal funds. Against this background, credit default swaps (CDSs) emerged. The first credit default swap was created by Bankers Trust in 1991 and widely developed by J.P. Morgan thereafter. Initially, the trading volume of CDSs was negligible. Data from the Bank for International Settlements (www.bis.org) show that the notional amount of credit derivatives including CDSs was only 0.7 trillion US dollars in 2001. From 2004, the notional amount of CDSs was independently calculated and the number rose explosively to 58.24 trillion of US dollars at the end of 2007. With such a surge in market value, CDSs have received great deal of attention from both academia and industry. After the financial crisis, some blamed them for increasing the systemic risk of whole market and a series of interests arose in exploring how the availability of CDSs affects the economy and entities in it.

Credit default swaps (CDSs) are contracts signed by two parties for transferring default risk. In most cases, they reference a specific debt of a firm or sovereign called a “reference entity”. The reference entity is neither the buyer nor the seller of a CDS and plays no role in the procedure of its creation. For each CDS transaction, the buyer pays the seller a premium in exchange for protection. The payment of the premium continues until either the default event or the expiry date of CDS contact, whichever comes first. If no default event happens, the CDS seller pays nothing to the buyer. However, in the event of default, the seller has the duty to compensate for the loss between insured principal and recovered amount or pay the face value of the bond, with physical debt delivery. Default events may be defined as failure to pay, bankruptcy, restructuring, rating downgrade and so on. Some CDSs might contain several or even all credit default events mentioned above. CDSs are similar to insurance contracts in which sellers can receive premiums and are required to give indemnities when losses occur. Nevertheless, there are several differences. First and foremost, a buyer of insurance should be the one suffering risk while a CDS buyer can have nothing to do with the credit event in the contract. Additionally, insurance companies are always regulated entities whereas CDS sellers may not be. Last, a reserve for covering sold protection is required for insurance but not for a CDS.

Single-name CDSs are the most popular and liquid device among various credit derivatives and account for a large portion of the whole credit derivatives market. Banks and lenders can use CDSs to reduce capital requirements asked by central banks, maintain relationship with clients, develop new business and even produce portfolios as alternative ‘risk-free’ assets. Credit risk can be traded easily through CDSs. According to Alexander, Edwards, and Ferri (1998), a large proportion of debt buyers hold corporate bonds to maturity. Consequently, the secondary corporate bond market remains illiquid. Buying and selling of large amounts are impossible in the secondary market. However, credit default swaps give participants the opportunity to go long or short credit risk on a large time span in unlimited amounts. One thing to be emphasized is that the buyer and seller of a CDS may not actually own the reference asset in the contract. For example, if an investor predicts the default of a corporate bond, he can buy the CDS for speculation without holding that bond. Therefore, the sum of notional value protected by CDSs can greatly exceed the value of the underlying asset itself.

Many people believe that CDSs are conducive to the efficiency of the financial system. Longstaff, Mithal and Neis (2005) claim that CDSs offer a near-perfect instrument to gauge the magnitude of the default component of corporate yield spreads. This suggests that CDSs provide pure credit risk premiums to investors in the market and facilitate price discovery. Moreover, Hull, Predescu and White (2004) find that CDS spread is negatively related to the credit rating of the reference entity and both changes and levels of CDS spread can effectively estimate the probability of downgrade. There seems to be an information channel from the CDS market to the rating market. However, a number of scholars criticize CDSs for their adverse effects on the economy. Subrahmanyam et al. (2014) find that the onset of CDS trading is positively related to the bankruptcy of reference entities and Arentsen et al. (2015) present evidence of CDSs increasing the default probability of underlying subprime mortgage loans. Furthermore, Minton, Stulz and Williamson (2009) show banks using credit derivatives for the purpose of dealer activity rather than risk hedging. This implies that instead of reducing risk CDSs put the bank system in danger. With such a collection of praise and blame, credit default swaps deserve attention. Augustin et al. (2016) argue that a deep understanding for potential CDS impacts is necessary.

CDSs create a hedging opportunity for investors to lay off their credit risk. This opportunity is important because it can erase the risk premium asked by creditors. Following the appearance of CDSs, creditors could hedge the default risk of those reference entities, undermining the significance of the risk premium. Nevertheless, CDSs might also have reverse traction on debt price. Parlour and Winton (2013) suggest that banks are reluctant to monitor borrowers if they can lay off their risk through buying CDSs. As a result, reference firms may invest in risky projects, leading to higher failure probability. In addition, CDSs generate exacting creditors, who are tougher in debt renegotiations pushing reference firms more easily into bankruptcy (Bolton and Oehmke, 2011). Since CDSs affect debt price in two opposite directions, their impacts are hard to judge at the average level. Ashcraft and Santos (2009) investigate the effect of CDS trading on debt costs but have not found strong evidence.

Our study is interested in whether CDS availability affects the yield spread between Treasury and corporate bonds and is linked to several others (e.g., Hu and Black, 2008; Bolton and Oehmke, 2011; Ashcraft and Santos, 2009; Parlour and Winton, 2013; Subrahmanyam et al., 2014; Arentsen et al., 2015). We seek to explain how CDSs influence the yield spread through either negative or positive channel. First, we develop a theoretical model for the yield spread in scenarios with and without the CDS market. Using this model, we show the mechanism between the yield spread and hedging opportunity/reduced bank monitoring/empty creditors and why the overall CDS effect should depend on a firm's credit when it issues bonds. Our empirical work starts from testing whether the CDS effect varies with firms' credits at issue times. We then investigate the two opposite CDS effects on the yield spread by splitting the sample into different groups based on CDS availability and credit proxy.

Many papers show the favorable impact of CDSs on the information environment (Longstaff, Mithal, and Neis, 2005; Acharya and Johnson, 2007; Hull, Predescu, and White, 2004). This suggests that the onset of CDS trading alleviates market imperfections, which contributes to lower finance costs. Also, CDSs constrain the likelihood of strategic default, helping to relieve the agency problem (Bolton and Oechmke, 2011). Moreover, Saretto and Tookes (2013) find that CDSs help to increase credit supply by breaking the separation between those willing to hold risk and those with capital. All these channels imply that CDSs may lead to stronger investment. However, an adverse CDS effect on investment also comes in several ways. First, CDSs reduce banks' monitoring interests (Parlour and Winton, 2013) making other lenders lose the opportunity to be "free riders". Additionally, CDSs generate exacting creditors which pressures firms to raise their cash reserves (Subrahmanyam et al, 2017).

This research tries to figure out whether and how the CDS market affects a firm's investment and is related to previous studies (e.g., Fazzari, Hubbard, and Petersen, 1988; Kaplan and Zingales, 1997; Allayannis and Mozumdar, 2004; Cleary, Povel, and Raith, 2007; Guariglia, 2008). Furthermore, we are interested in the effect of CDS use on a firm's investment-cash flow sensitivity. While altering a firm's capacity for getting external funds, CDSs change its demand for cash reserves as well. This inevitably influences the firm's whole capital status and its dependence on cash flow to investment. Since manufacturing needs the largest investments, we investigate both the broad sample, which contains all sectors, and the manufacturing sample. Considering the CDS effects on investment and the investment-cash flow sensitivity may vary, our analysis constructs a range of subsamples depending on firms' liquidities and integrities.

As a tool for transferring risk, CDSs alter not only the relationship between creditors and borrowers but also that between managers and outside shareholders. Easterbrook (1984) claims that a significant purpose of introducing external funds is to subject management to monitoring. With this, creditors potentially serve as protectors for outside shareholders although the monitoring is for their own interests. However, the inception of CDS trading slackens this mechanism (Parlour and Winton, 2013) and breaks the initial balance between two counterparties. Thus, through either an outcome or a substitute channel (La Porta et al., 2000), the incentive of managers on dividend policy may be changed. In addition, CDSs create empty creditors (Hu and Black, 2008) which could also affect corporate dividend policy. On the one hand, these creditors reduce managers' incentive towards "empire" leading to higher probability of cash disbursement. On the other hand, they make managers want to reserve more cash, putting pressure on dividend payment.

We seek to find the ultimate CDS impact on dividend policy among these conflicting effects and add to the literature (e.g., La Porta et al., 2000; Ferris at al., 2009; Jiraporn et al., 2011; Aggarwal et al., 2012; Hail et al., 2014; Louis and Urcan, 2015). Since agency conflict matters, we split our sample by its proxies to investigate whether the CDS effect on dividend policy varies. CDSs could affect the signaling role of dividends too. This is because managers' incentives to pay dividends are altered by them. If the substitute theory works, firms tend to use dividends to compensate reduced third-party protection due to CDSs. Conversely, if the outcome theory is true, dividends after CDS trading are more used to signal future earnings growth. Considering the variation in dividend information content, we also want to know whether there is an influence of CDSs on stock responses to dividend announcements.

1.2 Research Objectives

The objectives of our research are:

1) To investigate whether and how CDS availability affects the yield spread between Treasury and corporate bonds.
2) To identify any impact of CDSs on corporate investment and the investment-cash flow sensitivity.
3) To examine CDS effects on dividend policy, the signaling role of dividends and stock responses to dividend announcements.

We initially study the CDS effect on the yield spread by exploring changes the CDS market brings to creditors. In our theoretical framework, we show that arbitrage of creditors between the bond market and the CDS market gives the yield spread a downward momentum. To the contrary, the CDS market weakens bank minoring and creates empty creditors stimulating it upwards. The overall CDS effect is dependent on firms' credit conditions at issue dates. In our empirical analysis, we construct an interaction of the credit proxy and the CDS trading dummy to check the validity of the inference from our theoretical model. Afterwards, to understand the dominance of the CDS effect in different conditions, we split the sample using CDS availability and credit proxies. In this part, we answer four questions: How does the negative CDS channel affect the yield spread? How does the positive CDS channel affect the yield spread? Does the CDS effect on the yield spread vary with firms' credits on issue times? Does the negative CDS effect outweigh the positive during good credit periods and vice versa?

Our next objective is to investigate the CDS impact on firms' investments and their sensitivities of investment to cash flow. Considering that the investment decision is intertemporal, we use the first difference generalized method of moments (GMM) approach for estimations. Since manufacturing needs more investment in fixed assets than other industries, we present results for both the broad and the manufacturing samples. For testing whether CDSs attenuate the dependence of corporate investment on internal capital, we create an interaction of cash flow and the CDS trading dummy. Moreover, we split our sample by firms' cash flow levels; coverage ratios; ages and credit ratings to examine whether the potential CDS effects are different across groups. We address three questions: Is the emergence of the CDS market conducive to increasing private sector investment? Does the increase of corporate leverage after CDS trading really loosen financial constraints faced by firms? Do CDSs affect investment and the investment-cash flow sensitivity differently towards to good and bad liquidity/integrity firms?

A further aim is to identify whether and how CDS trading influences dividend policy, the signaling role of dividends and stock responses to dividend announcements. We first examine the CDS effects on probabilities of dividend payments, increases, continuities and decreases. Then, we extend our research to test whether these CDS effects are themselves affected by different levels of firms' free cash flows, firm ages and firm sizes. To observe the change of dividends' signaling role, we produce interactions of the CDS trading dummy with four dividend indicators. In addition, we use three days abnormal stock return as the dependent variable to investigate the CDS impact on stock responses to dividend announcements. Doing these, we solve the following questions: Do CDSs change the relationship between managers and outside shareholders? How does reduced third-party supervision affect managers' incentive towards dividend policy? The outcome theory or the substitute theory, which one really works? Have CDSs altered the purpose of dividend payments? Do investors in the stock market care about the change of dividends' information content?

1.3 Thesis Structure

The rest of this thesis is organized as follows. Chapter 2 reviews the literature on credit default swaps; debt pricing and bond markets; corporate investment; financial constraints; dividend policy and the signaling role of dividends. Chapter 3 investigates the CDS effect on the yield spread between treasury and corporate bonds. Chapter 4 examines how the emergence of the CDS market affects corporate investment and the sensitivity of investment to cash flow. Chapter 5 studies the impacts of CDS trading on dividend policy, the signaling role of dividends and stock responses to dividend announcements. Chapter 6 presents a summary of our findings and contributions.

Chapter 2

Literature Review

2.1 The literature on credit default swaps (CDSs)

Past research indicates that credit default swaps contribute to a more efficient financial market and bring some welfare to ease frictions. One such important example is the creation of new information. Hull, Predescu and White (2004) investigate the relationship between CDS spreads, credit rating announcements and bond yields. They find that CDS spread is negatively related to the credit rating of the reference firms. Higher rated firms always have smaller CDS spreads than lower rated firms. They expand their study to the relationship between rating announcements and spreads of credit default swaps, arguing that downgrade reviews from rating agencies contain outstanding information. Simultaneously, they find that either changes or levels of CDS spread can effectively estimate the probability of downgrade. Moreover, they study the association between bond yields and CDS spreads. Fixed income theory suggests that the difference between yields on the risky and the riskless bonds closes to the spread of credit default swaps. Their empirical work shows that the relationship suggested by theory holds well and can be used to estimate the risk-free rate implicit in the CDS market. These works imply that there exist some information sharing channels from the CDS market to the bond market and rating agencies.

Many studies investigate the effect of CDSs from a corporate finance perspective.

Saretto and Tookes (2013) study the impact of CDSs on the quantity and non-price contract terms of debt financing. They argue that CDSs can affect credit supply in three ways: (i) CDSs reduce capital requirements for banks and insurance firms asked by the regulator; (ii) CDSs help lenders make loans to clients for maintaining business relationship without taking credit risk; (iii) CDSs provide the opportunity to build risk free asset equivalents. They show empirically that, after the inception of CDS trading, reference firms have higher leverage ratios and longer debt maturities. To explore whether the finding is more significant under binding financial constraints, Saretto and Tookes investigate this CDS effect during a period of credit supply tightening. Models are re-estimated conditioned on aggregate time-series patterns, regional supply shocks and bank-specific supply shocks. All results show that the effects of credit default swaps on the firms' leverage and debt maturity become stronger when liquidity shrinks.

Normally, a CDS is viewed as having no effect on the credit risk of the reference firm. However, studies show that this possibility cannot be ignored. Hu and Black (2008) define CDS-protected lenders as "empty creditors" and claim that the financial interests of lenders with CDSs should be different from those of debt holders without them. Bolton and Oehmke (2011) are then first to model the empty creditor problem. They note that credit default swaps not only transfer the risk of the debt holder to the protection seller but also that they change the payoff of debt holder during financial distress. Comparing outcomes of owning or not owning CDSs, they investigate the empty creditor problem with a formal debt model in which commitment is limited. They find that CDSs strengthen the bargaining power of debt holders and reduce the likelihood of strategic default. The underlying explanation is that lenders are tough in debt renegotiations due to the protection of credit default swaps. However, they also find that creditors holding CDS are unwilling to restructure the debt even when it is efficient to do so. That appears to be because debt holders have an incentive to over-insure and large CDS position would change their payoffs in the event of default. Their model also shows that, when there are multiple debt holders, it is harder to reach an agreement on debt restructuring and the empty creditor problem deteriorates even further.

Subrahmanyam et al. (2014) test the effect of CDS trading on reference firms' credit risk and verify the existence of the empty creditor problem. They initially observe the variation of credit rating after the onset of CDS trading. Their "within-firm" analysis shows that compared to one year before CDS trading (t-1), credit ratings of the reference firms deteriorate two years after (t+2). Moreover, Standard & Poor's downgrades almost 37% of firms after they have been referenced by credit default swaps. Afterwards, difference-in-difference analysis also shows that CDS firms are more likely to be downgraded after CDS trading than non-CDS firms. They next expand to multivariate analyses to acquire further evidence of CDS impact on the credit risk of the reference firms. Empirical results reveal that the coefficient on CDS trading is still significant even after application of fixed effect controls. To explore the empty creditor problem, they study the probability of bankruptcy on distress when a firm is linked to CDS trading. Their results are consistent with creditors being inclined to push a distressed firm into bankruptcy once CDSs become available referencing its debt. They also find that if a firm's CDS contracts are mostly "no restructuring", creditors are more likely to push the firm into bankruptcy. Furthermore, they claim that the number of creditors increases after the inception of CDS trading and this goes against coordination at the time of financial distress. In general, their analyses demonstrate that CDS trading increases the credit risk of the reference firms.

Ashcraft and Santos (2009) are first investigate the effect of CDS trading on the cost of corporate debt. Many studies claim that credit default swaps improve the efficiency of the financial system and expedite complete markets, so an instinctive idea is that credit default swaps reduce the price of risk due to the new hedging opportunity and information created. This means that the cost of corporate financing may go down. Ashcraft and Santos investigate this issue in two ways. One is the effect of CDS trading on the cost of corporate bonds for underlying firms. The other is the effect on the cost of syndicated loans obtained from banks. Corporate-Treasury yield spread and loan-LIBOR (London Interbank Offered Rate) yield spread are employed as two dependent variables. They create two dummies, "traded" and "trading", for their study. The "traded" dummy is used to control invariant differences between CDS and non-CDS firms. The "trading" dummy is more important in investigating the impact of CDS trading on debt costs. The analysis initially focuses on the sample of CDS firms to observe the differences in debt costs after the onset of CDS trading. Then a matched sample of firms that are never referenced by CDSs, but have similar characteristics to those are, is constructed as a control group. However, they do not find evidence that CDS trading lowers debt costs on average after controlling for firm-specific variables, bond or loan features variables, and time dummies.

The emergence of a CDS market changes lenders' incentives for monitoring and also their attitudes toward debt restructuring. These changes inevitably affect CDS reference firms when they make cash holding decisions. Looser monitoring encourages the firms to take on risk and reduce cash holdings for maximizing their equity value but tougher lenders increase the firms' liquidity costs and their need to retain cash. Subrahmanyam et al. (2017) investigate how cash holding varies after CDS initiation between the converse impacts of risk-taking and exacting lenders. They find that the exacting lender effect, on average, dominates the risk-taking effect. This means that the cash holdings of reference firms rise after CDS trading becomes available. Their further analyses show that the increase of cash holding is only significant for firms that never pay dividends and firms without bank debt. That can be evidence of existing risk-taking effect although it is rather weak. They also explore the mechanism behind the raising of cash holdings. Results indicate that the increased cash is from the issuance of long term debt rather than cash flows coming from operations. After the initiation of CDS trading, reference firms increase their leverage and cash holding at the same time. A strategy of high leverage with high cash holding is more profitable for shareholders. This finding suggests that a part of increased leverage is used to raise cash reserves.

The growth of CDS related studies is as fast as the inflation of CDS market value. To make a periodical review of literature in recent decades and shed light on the further direction of CDS study, Augustin et al. (2016) give a narrative expatiating on the past, present and future of credit default swaps. They summarize the literature in four dimensions. First are the pros and cons the CDS market brings to the economy and involved entities. This aspect pays main attention to how the inception of CDS trading affects asset pricing, economic behavior and the relationship between lender and borrower. Augustin et al. (2016) claim that gaps for this aspect are more specified findings of CDS benefits, the externality implications of CDSs and how the intensity of CDS trading matters; secondly, in the post-crisis era, the effects of stringent regulations on CDS market circumstances, especially Basel III and Dodd-Frank. They note that we know little about the effects of these regulations on credit default swaps and related financial products. Moreover, some CDS issues stand at the crossroads between finance and law. For example, whether it is reasonable to give empty creditors the right to vote in a debt restructuring. Also, the use of CDS information to study sovereign risk and the spillover from sovereign risk to firm risk. They conclude that attention should be paid towards exploiting the CDS information implied by term structure, CDS trading volume and international CDS corporate data.

Arentsen et al. (2015) are first to provide empirical evidence that credit default swaps (CDSs) adversely affect defaults of subprime mortgage loans. Their work exploits a large sample of mortgage loans, originated and securitized by finance companies, investment banks and commercial banks during the period from 2003 to 2007. Loan delinquency is used to measure the performance of subprime loans. Arentsen et al. compare the quality of borrowers with and without CDS coverage. They find that borrowers' FICO scores are lower when loans are covered by CDSs (FICO is an acronym for the Fair Isaac Corporation, introduced in 1989 and used by the majority of US banks and credit grantors; based on consumer credit files of the three national credit bureaus: Experian, Equifax, and TransUnion). Afterwards, they investigate the effect of CDS coverage to mortgage default. Their first finding is that CDS coverage has a positive effect on the delinquency probability of mortgage loans. Secondly, they find that loans originated after the start date of a CDS show a high default frequency compared with loans originated before. Thirdly, the effect of CDS also depends on issuers' types. Although delinquency rates of loans with CDS from all commercial banks, investment banks and finance companies are higher than those without, the difference of rates from commercial bank loans is the largest. Arentsen et al. (2015)

claim this phenomenon is because commercial banks using soft information to construct mortgage pools.

Minton, Stulz and Williamson (2009) study the extent to which banks use credit derivatives for the purpose of hedging loans. They focus on companies that belong to US banks and have assets over 1 billion dollars during the period from 1999 to 2007. According to Board of Governors of the Federal Reserve (2002), credit derivatives contain “credit default swaps, total rate of return swaps, synthetic collateralized loan, debt, and commercial paper obligations, and other credit derivative instruments.” They analyze the sample excluding foreign bank holding companies. They find that only a few banks exploit credit derivatives (23 out of 395 in 2005). Using net credit protection purchase as a criterion of bank hedging, this hedging accounts for less than 2% of banks’ loans outstanding although the nominal amount of banks’ credit derivatives outweighs that of their credit exposure. This means the purpose of using credit derivatives is dealer activity rather than risk hedging for banks, which have credit derivatives positions. Secondly, Minton, Stulz and Williamson use probit models to discover why banks have net credit protection purchase. Their empirical work shows that banks having less capital are inclined to buy net credit protection. This supports the idea that net purchase of credit protection is made in order to reduce capital requirements rather than to hedge credit exposure. In general, they argue that few banks use credit derivatives and do so for dealer activities.

Parlour and Winton (2013) model the behavior of banks when they want to lay off their credit risks. There are two ways to unload the credit risk of holding a loan. The first is buying single name credit default swaps for protection. The second is selling the loan to other institutions. Differences between these two choices are the control right for cash flows and the willingness to monitor. In their model, a firm that raises money for a project has net positive present value and will exist for five periods. At time 0, the bank originates the loan and the firm uses the money to finance a risky project. At time 1, the bank learns private information about the management of the project and faces a capital shock. At time 2, the bank chooses to lay off the risk of the firm through a credit default swap or a loan sale. At time 3, the owner of the loan (i.e. the originating bank or the loan buyer) exerts a costly effort to make the project good. At time 4, the firm pays off all claims and the model ends. The authors assume that, given the opportunity, the firm tends to make the project risky and it is socially inefficient in doing so. They claim that (i) the transfer of risk leads to inadequate monitoring of safer loans and exorbitant monitoring of riskier loans; (ii) if the cost of a bank's equity capital increases, the effect mentioned above is aggravated; (iii) banks typically choose loan sales rather than CDSs to unload credit risk for riskier loans; (iv) credit default swaps dominate loan sales as a tool to lay off risk for safer loans considering reputation and repeated lending.

Roberts and Whited (2011) demonstrate methods for addressing the endogeneity problem in empirical corporate finance. They claim that endogeneity is the most important matter that should be considered before corporate finance studies. Broadly speaking, endogeneity is a correlation between exogenous variables and the error term. Omitted variables, simultaneity and measurement error are causes for endogeneity. Roberts and Whited introduce three methods to solve endogeneity: instrumental variables, regression discontinuity design, and difference-in-difference estimators. They argue that instruments should satisfy two requirements. One is a relevance requirement that the instrument be partially correlated to the endogenous variable. The other is an exclusion requirement requiring the covariance of the instrument and the dependent variable to be zero. The method uses instruments to estimate a two-stage least squares. First, use all other explanatory variables and instruments to estimate the predicted value of the endogenous variable. Then, use the predicted value to replace the endogenous variable in the regression and carry out a formal OLS. They note that difference-in-difference estimators are normally employed to investigate the treatment effects. To study the effect of sudden policy or environment changes, there are two ways that either compare the difference between before and after inception or the difference of ex post outcomes between control and treatment groups. These differences complement one another. The comparison of cross-section avoids probable omitted trends while the comparison of time series avoids potential divergence between groups. In order to compare cross-sectional differences, we need to find that the counterparty has similar characteristics. They also present the means, propensity score matching, to find a matched sample.

2.2 The literature on debt pricing and bond markets

Yield spread is defined as the difference between a rate of return on a security and a benchmark rate. The benchmark rate used depends on the purpose of the research. The normal benchmark rate is the Treasury yield rate with the same maturity since Treasury bonds are liquid and essentially risk-free. The yield spread measures risks of holding an individual security compared to the same maturity Treasury. Large spread means high risk. The risks considered here are various, including credit risk, liquidity risk, event risk and option risk. However, the main risks are the first two: credit risk and liquidity risk. Credit risk contains the information of default frequency and recovery rate that are essential to investors, so it attracts especial concern. Elton et al. (2001) show that the yield spread can be explained by expected default loss, tax premium and risk premium. Collin-Dufresne et al. (2001) suggest that the changes of the yield spread are dependent upon the variation in state variables. Huang and Huang (2012) find that only 30% of the yield spread can be explained as a compensation for the credit risk of corporate bonds. This implies that the remaining yield spread is largely due to liquidity risk.

Collin-Dufresne, Goldstein and Martin (2001) try to find elements affecting changes of the credit spread between corporate and Treasury bonds. They use dealers' quotes of straight industrial bonds to obtain transaction prices. Callable and puttable bonds are excluded from their sample. Data are monthly and the sample period is from July 1988 to December 1997. They suppose that credit spread comes from two fundamental factors: the existence of default risk, and in the event of default, creditors only receive a recovered amount that accounts for a small proportion of the completed payments. Consequently, they try to explain changes in the credit spread by proxy for either changes of the default probability in future time or changes of the recovery rate. Theory for bonds suggests that credit risk contains spot rate changes risk, yield curve slope changes risk, leverage changes risk, volatility changes risk and business climate changes risk. Thus, they construct a structural model to investigate whether changes of theoretical determinants can explain variations of credit spreads. Their first finding is that theoretical factors only account for 25% of credit spread changes. Secondly, residuals from their regressions display high cross-correlation. Through analysis of principal components, they find that these residuals arise mainly from a single common factor. This means that if omitted explanatory variables existed, they would not be firm-specific. However, the authors fail to find a set of variables to explain this common systematic factor, though several macroeconomic, financial and liquidity variables are tried. Their finding indicates that local supply or demand shocks give rise to the chief component in monthly changes of credit spread of corporate bonds.

Elton et al. (2001) attempt to explain the yield spread between corporate and government bonds. The literature suggests that the difference of return rates for risk and risk-free bonds comes from three strands: expected default loss (determined by default frequency and recovery rate), tax premium, and risk premium. Elton et al. estimate the sizes of these three components on corporate-Treasury yield spreads. Firstly, they assume investors are risk neutral and estimate the spot spreads between corporate and government bonds considering only expected default loss. To complement this task, they need to estimate marginal default probability and recovery rate. They use a function of rating to estimate recovery rate and two transition matrixes from S&P and Moody's to estimate marginal default probability. Secondly, they re-estimate the spot spreads taking both the tax premium and the expected default loss into consideration. They show that the spot spreads are not sufficient to explain the corporate-government yield spreads considering only expected default loss and tax premium. Then, they investigate whether the unexplained spread is driven by risk premium. They verify that the risk premium largely explains the rest of the spread. They suppose that the risk premium is a compensation for systematic risks. The logic behind this is that returns of corporate bonds systematically vary with that of other assets whereas returns of Treasury bonds do not. Moreover, there is an interesting finding that tax premium has more explanatory effect than default loss, which is always emphasized in textbooks.

Huang and Huang (2012) investigate how much the size of Corporate-Treasury spread can be attributed to credit risk. They exploit a structural approach, based on the option pricing ideas of Black and Scholes (1973) and Merton (1974). Their approach requires structure models to confront the observed historical data on equity risk premium as well as on bond defaults. A multitude of structure models considering stochastic interest rates, stationary leverage ratio, endogenous default and strategic default are employed. Moreover, they both introduce a model with jumps in firm value and time-varying premium for asset risk. They show that, within the structural models, the quantitative degree of credit spread can reach a strong consensus if each model is first calibrated to equity risk premium and historical default loss. Specifically, they find that credit risk can only explain a small portion of the spread for highly rated bonds of all maturities. However, they find that the credit component in the yield spread is fairly large for junk bonds. They argue that structural models have little explanation on yield spreads of high quality bonds if the models are calibrated to equity risk premium and historical default loss. The first implication of their work is that a new structural model is needed if there are model misspecifications. The second is that illiquidity, tax premium, and risk premium play a big role in yield spreads on investment-grade bonds. Furthermore, they do not find a correlation between bond defaults and business cycles.

Bao, Pan and Wang (2011) study the illiquidity of corporate bonds and its implications for asset pricing. After the financial crisis, a multitude of studies pay attention to an illiquidity problem in the US corporate bond market. They claim that, although illiquidity and credit risk both drive up corporate bond spreads, it is not clear which factor is dominant. Instead of using percent of trading day and quoted bid-ask spreads, they construct a simple yet robust proxy (Υ) for illiquidity. Υ is defined as "the negative of the autocovariance in relative price changes". The effect of illiquidity on corporate bond pricing is investigated either at the individual bond or aggregate level. They find that aggregate illiquidity is correlated with market risk as measured by Chicago Board Options Exchange Volatility Index and credit risk as captured by CDS index. Aggregate illiquidity doubled in 2007, tripled at the time of Bear Sterns collapsing and was five times when Lehman Brother defaulted. In addition, their results show that illiquidity dominates credit risk turning into the primary factor in explaining monthly changes of aggregate high-quality bond spreads. At individual bond level, a significant and positive relationship between bond illiquidity and yield spread is found after controlling for credit risk as proxied by CDS spreads. In sum, they argue that illiquidity is substantial in corporate bonds and more than the explanation of bid-ask spreads of bonds. Furthermore, they also suggest that the age, maturity and trade size of bond are correlated with its illiquidity and the illiquidity will become stronger after price decrease.

Using information from CDS markets, Longstaff, Mithal, and Neis (2005) examine the components of yield spread on corporate bonds. How much of corporate yield spreads arise from default risk and non-default factors, such as taxes and illiquidity, is an important issue for both investment and corporate finance perspectives. Although a number of studies try to address this issue, most are limited by having only bond data. Longstaff, Mithal, and Neis extract information from CDS spread to measure default risk. They claim that credit derivatives offer researchers a near-perfect instrument to gauge the magnitude of a default component on corporate yield spreads. To measure the magnitude of a default component, they employ two approaches. One is using the

CDS spread directly to represent the default component. The other is using a reduced-form model to calculate the magnitude of the default component. A series of riskless rates including swap curves, Refcorp, and Treasury are used to calculate corporate bond spreads. Through empirical tests, they find that most of the corporate bond spread is accounted for by a default component. This finding is across all credit ratings. Specifically, using Treasury as the riskless rate, the default component explains "51% of the spread of AAA and AA bonds, 56% for A-rated bonds, 71% for BBB-rated bonds, and 83% for BB-rated bonds". Nevertheless, they also find the effect of non-default factors on corporate bond spreads. The non-defaulted component is highly related to gauges of bond-special and market illiquidity. Moreover, it is time varying.

In contrast with stocks or Treasuries, corporate bonds normally face liquidity problems. Thus, prices of corporate bonds reflect not only credit risk but also liquidity risk. Correspondingly, credit and liquidity premium compose the yield spread between corporate and Treasury bonds. With the emergence of credit default swaps, a number of researchers use CDS spread as a perfect representation of credit risk to study the liquidity component of yield spreads of corporate bonds. However, whether this method is appropriate depends on CDS liquidity and its impact on CDS spread. Chen, Fabozzi and Sverslove (2010) investigate the liquidity of corporate credit default swaps and its implications for yield spreads of corporate bond. They first analyze the bid-ask spreads in credit default swaps and find that these spreads are wide for many CDS quotes. The bid-ask spread on average is 30 percent of middle prices of ask and bid. Secondly, they study the dynamics of credit and liquidity factors. A two-factor affine model is employed to estimate liquidity premium in CDS spread. They find that the liquidity factor is both statistically and economically significant. The bid-ask spreads can be largely explained by the premium of liquidity risk. In addition, they argue that the premium of liquidity risk in CDS quotes is not correlated with credit risk though liquidity is. Furthermore, their simulations imply that a small premium for CDS liquidity can raise a huge liquidity discount in the prices of bonds. After considering liquidity in their model, they find no significant difference between CDS spreads and yield spreads of bonds.

Greenwood and Hanson (2013) investigate the relationship between issuer quality and returns of corporate bonds. In most studies relating to credit cycles, variations of credit quantities are mostly explained by changes of bank capital and borrowers' net worth. However, Greenwood and Hanson (2013) argue that the allocation and quantity of credit largely depend on time-varying tastes or beliefs of investors. In their research, historical data over eighty years are employed. They make a link between corporate bond financing and time-series change in credit risk pricing. The basic idea is that financial costs for high-risk firms are disproportionately affected by broad variations in pricing credit risk. Consequently, the bond issuance of high-risk firms is probably useful to measure financing conditions. Specifically, they claim that changes in bond issuer quality may be effective for forecasting excess corporate bond returns. To test the hypothesis, they construct time-series gauges of bond issuer quality. The first gauge compares the expected default frequency of firms with high bond issuance to that of firms with low bond issuance. The second gauge computes the proportion of issuance of speculative bonds. Their empirical work shows that the average issuer quality decreases when the quantity of aggregate credit grows. Then, they employ these issuer quality gauges to forecast corporate bond excess returns. They discover that Treasury bonds perform better than corporate bonds when issuers have poor quality. The magnitude of return predictability is large in either economic or statistical terms. Moreover, they also find that the forecasting power of issuer quality for excess bond return is incremental above that of macro variables and even the aggregate bonds issuance.

He, Qian and Strahan (2012) investigate whether investors will charge more if MBSs are issued by big companies. They test the impact of issuer size on the yield spread (both ex ante and ex post price) of MBSs. Almost all MBS tranches originated from 2000 to 2006 receiving at least one rating from Moody's, Fitch or S&P are included in their sample. The sample is divided into AAA tranches and non-AAA tranches. Models are regressed without distinguishing issuer size at first. Next, the sample is split into AAA tranches issued by big companies, AAA tranches issued by small companies, non-AAA tranches issued by big companies and non-AAA tranches issued by small companies. A big company was defined as top 10 in market share for the given year. They find that initial yield spread of MBS is positively related to issuer share in both AAA and non-AAA tranche samples. Moreover, the price of an MBS issued by a big company decreases more than that issued by a small one after origination in non-AAA tranches sample. An extra finding is that an MBS issued by a small company with only one rating is priced more than that with all three ratings from Moody's, Fitch and S&P. This means that investors also consider the possibility of shopping for the best rating.

Dass and Massa (2014) investigate how the variety of maturities offered by corporate bonds affects the investment choice of institutional investors. In the US corporate bond market, some firms provide their bonds with various maturities. For example, IBM offered 13 bonds with 12 maturities ranging from 1 to 89 years. Do investors treat firms with various bond maturities, like IBM, differently? Moreover, does the variety of bond maturities have any impact on bond yields? Dass and Massa (2014) give the first empirical evidence. The data they use are from the first quarter of 1998 to the second quarter of 2007 on institutional holding of corporate bonds. The largest buyers of these corporate bonds are mutual funds and insurance companies. Dass and Massa (2014) argue that firms with various bond maturities are attractive to institutional creditors because the creditors can save the expense of collecting information. The pivotal insight is that several institutional creditors need to invest both short-term and long-term assets and the convenience of various bond maturities reduces the cost of information collection. They find that bonds weight and portfolio holdings of institutional creditor have a positive relationship with the maturity variety of a firm. This is especially true for larger institutional creditors. In addition, they discover that the demand of a fund for holding a firm's bond is higher when its "sister funds" also hold bonds from the same firm. Afterward, Dass and Massa test whether a firm's maturity variety affects its bond yields. The result shows that bond yields of firms with various bond maturities are lower than those of firms with similar characteristics.

Griffin, Lowery and Saretto (2014) test the assumption that higher-reputation companies originate good securities. General knowledge suggests that underwriters with good reputation originate high-quality financial products. The insight here is that it is costly to build a good reputation, so underwriters would not sacrifice their long-term benefits in exchange for maximizing their short-term profits. However, Griffin, Lowery and Saretto (2014) develop a model showing this suggestion might be wrong when considering complex securities. In their model, a two-period reputation is assumed. Underwriters have partial ability to control a security's payoff in bad and good financial states through selecting the quality of collateral and assets correlation. Investors find it hard to analyze the performance of assets in the financial state they cannot observe because the securities are complicated. Investors can only know a bad payoff when the bad state occurs whereas underwriters can know in both good and bad states. Their model suggests that good reputation increases the incentive of strategic underwriters to produce low-quality complex securities. Moreover, their model indicates that strategic underwriters would ceaselessly produce low-quality securities until a financial crisis. They use a large number of complex securities to verify their theoretical model. Complex securities include collateralized loan obligations, collateralized debt obligations, asset-backed securities, and mortgage-backed securities. The sample period is from January 2000 to December 2010. Empirical analysis shows that the performances of complex securities issued by higher-reputation companies are even worse than those issued by obscure companies. Furthermore, higher-reputation underwriters continually created poor securities before the financial crisis in 2008.

2.3 The literature on corporate investment and financial constraints

Exploration of the investment-cash flow sensitivity has continued over decades. Fazzari, Hubbard, and Petersen (1988) propose that the sensitivity of investment to cash flow can be used as a proxy for financial constraints. Employing dividend payout ratio as their criterion, they split their simple into financially constrained firms, possibly financial constrained firms and not financially constrained firms. They propose that retention practices give a useful indicator to identify which firms face external financial constraints. Their empirical results demonstrate that firms which pay low dividends (i.e. they may be facing financial constraints) depend heavily on their cash flows for investment. The stronger the dependence, the heavier the constraints. The feasible explanation given by them is that it is hard to access either new debt or equity from external financing when a company faces financial constraints. As a result, internal funding (cash flow) is the only source for its investment and operation. Moreover, they argue that investment would be sensitive to the aggregate tax burden if external financing cannot perfectly substitute internal financing.

Different thinking comes from Kaplan and Zingales (1997), who oppose using the investment-cash flow sensitivity as the proxy for financial constraints and challenge the findings of Fazzari, Hubbard, and Petersen (1988). They analyze the subsample in Fazzari et al. (1988) including 49 firms with low dividend payouts. The subsample is again split into three groups that are firms likely constrained, firms possibly constrained and firms never constrained. However, the separation criterion they use is not based on retention practices but qualitative information from firms' annual reports and quantitative data in firms' financial notes. They find that, in the three groups, firms never constrained display the highest sensitivity of investment to cash flow. Their analysis shows that firms with high interest coverages and those always paying dividends (i.e. financially unconstrained firms) are more dependent on cash flow for investment than other firms in the sample. Thus, they argue that the investment-cash flow sensitivity ought not to decrease monotonically with the loosening of financial constraints.

Allayannis and Mozumdar (2004) try to reconcile the different empirical findings from early studies. They suppose that negative cash flow observations may result in the more constrained firms displaying lower the investment-cash flow sensitivity; when a firm faces financial distress, it becomes more radical in investment decision-making due to the desire to win money back. As a result, investment cannot respond to its cash flow. Allayannis and Mozumdar (2004) revisit the work of Kaplan and Zingales (1997) but exclude negative cash flow observations. The results after this modification are similar to those of Fazzari et al. (1988). They also replicate the work of Cleary (1999) without negative cash flow observations deriving the same conclusion. Moreover, they document a decline in the sensitivity of investment to cash flow during the period 1977-1996, especially for more constrained firms.

To shed light on the debate, Cleary, Povel, and Raith (2007) study the effect of internal funds on corporate investment via both theoretical and empirical approaches. Their model demonstrates a U-shaped relationship and the investment-cash flow sensitivity rests with the interaction between revenue and cost effects. When its cash flow decreases, a firm has an incentive to reduce investment since the cost of external financing is higher than that of internal financing (the cost effect). However, the firm may also consider increasing investment to improve cash flow (the revenue effect). The decisive factor is the marginal gain of investment at different cash flow levels. They argue that the revenue effect dominates the cost effect when a firm faces high default risks (negative cash flow) and vice versa. They expand their study to empirical analyses using real data. Two proxies of internal funds are employed to plot investment and they get the U-shaped chart. Their standard regression also shows that the function of investment on internal funds is quasi-convex.

Guariglia (2008) argues that contradictory findings in empirical work are due to different indicators used to measure financial constraints. She employs a UK firms panel including over twenty thousand individuals, 90 percent unlisted in the stock market. Following Bond et al. (2003) and Bloom et al. (2007), she uses an error-correction model. With cash flow level/interest coverage ratio as a measure of internal financial constraints, her sample is split to three groups: negative cash flow/coverage ratio, medium cash flow/coverage ratio and high cash flow/coverage ratio. She claims that, with these measures, a U-shaped investment-cash flow curve arises. Correspondingly, she divides the sample into small/young, medium/middle-aged and large/old groups according to firms' sizes/ages. Her results indicate that the relation between cash flow and investment is positive and convex under this classification.

Besides Kaplan and Zingales (1997), the other challenge Fazzari, Hubbard, and Petersen (1988) face is from Chen and Chen (2012), who argue that the sensitivity of investment to cash flow is disappearing. To display this trend, they analyze US data with a long sample period, from 1967 to 2006. According to product category, they group firms into 3 subsamples: durable goods industry, non-durable goods industry and high-tech industry. For each subsample, the investment-cash flow sensitivity is estimated every 5 consecutive years, displaying declining trends in that. Their cross-sectional regression shows that the investment-cash flow sensitivity is 0.33 in 1967 but 0.02 in 2006. They claim that the investment-cash flow sensitivity cannot be a good indicator for financial constraints since capital imperfection is still outstanding. This conclusion is challenged two years later by Lewellen and Lewellen (2014). Using different measure of cash flow, they find that the investment-cash flow sensitivity not only exists but also is significant.

Early papers use static models to estimate investment while Gatchev et al. (2010) note that the nature of financial decisions is intertemporal. For example, investment this year is determined by both cash flow this year and investment last year. When cash flow shortfall comes, firms may not definitely cut down their investments but use external financing to continue investing because adjusting investment plan is highly costly. As a result, using a static model may lead to biased coefficient estimations. They investigate numerous financial decision variables: capital expenditures, acquisitions, asset sales, equity issues, change in long-term debt, change in short term debt, change in cash flow, etc. Their results indicate that most financial decision variables are significantly related across time. Thus, lagged dependent variable should be included in the specification. In addition, they find that there exist interdependent effects within these decision variables.

2.4 The literature on dividend policy and the signaling role of dividends

The information asymmetry between a firm's management and outside shareholders makes dividend payment a necessary device to signal firms' prospects. As a costly signal, the disclosure of dividends accompanying other disclosures helps to enhance firms' information environments. Thus, many theoretical papers suggest that firms with severer information asymmetries are more likely to pay and increase dividends to avoid concerns about their outlooks. However, little empirical evidence is found to support this prediction for US quoted firms. Leuz and Verrecchia (2000) and Huddart and Ke (2007) explain this inconsistency by inadequate changes across US quoted firms in the information environment. Based on the idea that extents of information asymmetries are more diverse for ADR firms that are non-US firms but cross listed on the US markets, Aggarwal et al. (2012) examine the role of information environment in affecting dividend changes, using ADR firms' data. To measure the differences in information asymmetries, they employ three proxies: institutional following, trading volume and analyst following. They find that ADR firms under impoverished information environments more easily use dividend increase as a signal of a bright future for outsiders and the increased amounts are large. They simultaneously analyze the informativeness of dividend changes in forecasting prospective earning changes, finding that dividend changes can predict variations of future earnings but only for ADR firms in sparse information environments. Lastly, they extend their research to the relationship between dividend initiation and information environment but fail to find sufficient evidence in this case. This is in accordance with Bulan et al. (2007) and Grullon et al. (2002) that dividend initiation denotes approaching maturity rather than being a signal for prospects. The main contribution of their paper is to support the theory that the signal role of dividend increase is important and does exist.

Deangelo et al. (2008) suppose that firms use dividends to relieve outsiders' doubts that managers will overinvest, destroying free cash flows and firm values. This arises from information asymmetry and firms' incentives for paying and increasing dividends vary with its severity. Then, if there are shocks that change information environments, firms' dividend policies can also be affected. Hail et al. (2014) investigate the relationship between information shocks and corporate dividend policy. Two national-level events are viewed as driving forces that improve the environment of information. One is the global coercive enforcement of International Financial Reporting Standards (IFRS) around 2005. The other is the prosecution of insider trading laws by a series of countries after 1990. Several papers show that both these events allow analysts more easily to forecast corporate performances and improve the quality of financial reports (e.g., Bushman et al., 2005, Landsman et al., 2012, Jayaraman, 2012). Hail et al. (2014) find that after a country requires firms to adopt IFRS, firms in that country are less likely to pay or increase their dividend payouts but are inclined to reduce or terminate them. A similar outcome is observed using the initiation of insider trading laws as the trigger event. In addition, they study the variation of market response facing dividend disclosures after two events. Using the sum of stock returns on days before, on and after dividend disclosure as the dependent variable, they show that, after improvement of information environments, stock markets respond less to dividend announcements than previously. Finally, they discover that the decrease of dividend payouts after two events are more pronounced for firms in code law nations, firms with large management shareholdings and firms used to finance projects by external funds. This is in accordance with firms under these conditions exhibiting greater free cash flow agency costs.

A state shareholder is distinctive among investors and can affect corporate governance on several dimensions. First, firms with large government holdings are viewed as inefficient, non-transparent and value-destroying and contribute a higher level of information asymmetries. Secondly, the management of a state-controlled firm may not only be interested in maximizing the firm's value but also in political targets. Specifically, there are two opposite possibilities when considering how state ownership affects dividend payouts. The substitute theory of dividends suggests that firms suffering severer information asymmetries (here firms with partial government ownership) are likely to pay and increase dividends. Additionally, the pecking order theory (e.g., Myers, 1984; Verrecchia, 2001) suggests that firms facing higher agency costs have fewer investment opportunities and, thus, do not need to retain so much free cash flows, which can be paid as dividends. Furthermore, firms partially-owned by a state depend less on internal cash flows because they can more easily obtain external financing (e.g., Chahrumilind et al., 2006; Chaney et al., 2011) and the life-cycle theory implies that such firms have higher propensity to disgorge cash (e.g., Fama and French, 2001; Grullon et al., 2002; DeAngelo et al., 2006). On the other hand, the outcome theory indicates that firms that lack monitoring and are poorly-governed, making it hard for outside shareholders to force profit distributions. Ben-Nasr (2015) studies the impact of government ownership on a firm's dividend policy using global data. He identifies a firm as partially-held by the state if the government accounts for more than 10 percent of its total shares and finds that state ownership decreases a firm's dividend payout. This is supporting evidence for the outcome theory that firms with higher agency costs are less likely to pay or increase dividends. He expands the study to situations in which the negative relation between state ownership and dividend payout is more pronounced, showing that the negative relation is more significant for firms in countries with low investor protection and fewer political constraints. This again supports the outcome theory.

The literature suggests that accounting conservatism is negatively-related to corporate distribution. However, most research concentrates on a mechanism whereby conservatism reduces firms' earnings and retained earnings. The information asymmetry between shareholders and creditors creates the need to limit dividend payments. Normally, a limitation will emerge in the form of debt covenants that make dividend payouts conditional on the amounts of firms' earnings or retained earnings. As a result, conservative accounting reduces dividend payouts by restricting incomes.

However, Louis and Urcan (2015) claim that the role of accounting conservatism in reducing dividend payouts far transcends the argument of covenant restriction. Agency theory indicates that a purpose of dividends is to mitigate the concern that managers might over-invest free cash flows for making their "empires". If accounting conservatism can reduce this concern, it is rational that firms pay out less in dividends. According to Watts (2003), conservatism leads to sufficient ex ante project estimation and effective ex post project monitoring that alleviates the insider-outsider agency problem. Moreover, Ball and Shivakumar (2005) show that the incentive of taking a risky project is decreased under conservatism. Louis and Urcan (2015) find that accounting conservatism reduces corporate dividend payouts even after controlling for the covenant restriction effect. In other words, the negative relationship is due to the reduced agency problem rather than restricted earnings. In addition, they find that this negative relationship is more pronounced for firms with greater free cash flows, firms lacking lender monitoring, firms with bad credits and non-family firms. Their paper contributes to the literature in three strands. First, accounting conservatism is an important determinant of dividend payouts. Secondly, accounting conservatism can be used as a substitute for costly dividend payments for reducing information asymmetries. Finally, conservatism not only alleviates the agency problem between shareholders and creditors but also the agency problem between shareholders and managers.

Cumulative studies show that dividend payouts are determined by corporate governance, national legal regime and a series of firm-specific variables, such as leverage, sale-growth, earning, Tobin's q and cash holdings. However, empirical findings are contradictory when using data from different countries even after taking these ingredients into consideration. According to La Porta et al. (2000), firms in those countries with better investor protections are inclined to pay and increase dividends because minority shareholders can effectively use legal rights to force corporate distributions. In contrast, Ferris at al. (2009) find that firms in civil law countries, which lack investor protections pay more dividends as substitute for legal guarantee. A fierce debate between supporters of the outcome theory and the substitute theory leads Bae at al. (2012) to the idea that dividend policy may relate to different national cultures around the world. They claim that culture can affect dividend policy in several ways. For example, managers in a country under an aggressive culture more likely behave overconfidently and engage in value destroying projects that worsen the agency problem. Moreover, they argue that culture determines the financial flexibility of a nation and this flexibility is one of the most important factors when firms make dividend decisions. Bae at al. (2012) investigate how culture influences dividend policy and the impact of corporate governance on this association. Hofstede (1980) claims that culture is a gathering of public faith, behavior rules, common values and moral norms for society. Bae at al. (2012) use the extent of masculinity, uncertainty tolerance and long-term orientation as three proxies for culture. They find that firms pay lower dividends under the cultures of masculinity, uncertainty averseness and long-term thinking. Additionally, they reveal that the negative relation between culture and dividend payouts varies with corporate governance. In countries where governances are weaker, as measured by the index proposed by Atanassov and Kim (2009), the effect of culture on dividend payouts is more significant.

Rommens et al. (2012) study dividend payments of privately held firms using Belgian data. In Belgium, privately held firms account for the vast majority of all firms and most of them have financial statements in the public domain. These conditions make

Belgium a perfect nation to explore the difference in dividend policies between privately held firms and public firms. Rommens et al. find that privately held firms in Belgium are less likely to pay dividends. They explain this in two ways. Managers in privately held firms always own large share positions and other investors are closely related to insiders. As a result, the information asymmetry between managers and outsiders is smaller for privately held firms, contributing to weak incentive for using dividends as a positive signal for future earnings or a commitment not to destroy free cash flows. Secondly, dividends are costly for firms from the perspective of taxation because they are taxed twice both at the firm level and the investor level in many countries. For privately held firms where most investors are managers, it is more profitable to pay shareholders tax-exempt bonuses rather than taxable dividend payments. They next focus their attention on whether dividend policies of stand-alone firms are dissimilar to those of group firms. In Belgium, dividends from subsidiaries to holding firms within the same group are not taxed by the government and so group firms are more likely to pay and increase dividends than stand-alone firms. Moreover, dividends can serve as internal financing within one group, leading to high frequency. Empirical findings from Rommens et al. (2012) support these arguments. Lastly, they find that group firms with outside minority investors are more willing to make dividend payments. This is consistent with the substitute theory of dividend that firms with high agency costs pay more dividends.

Besides dividend payments, stock repurchase is the other important distribution form in cash disbursement. In the United States, stock repurchases became increasingly popular during the period 1980 to 2000 and overwhelmed dividends as the first way of corporate payout in the beginning of the 21st century (Grullon and Michaely, 2002).

According to Miller and Modigliani (1961), stock repurchases and dividends are substitutes for each other if there is a perfect capital market. Of course, market frictions exist in reality and the differential tax burdens on stock repurchases and dividends affect this substitution. The tax rate on dividends is historically higher than that on stock repurchases in America. In contrast, dividends in Australia generate imputation tax credits making them not tax-disadvantaged and this tax environment allows testing of the substitution hypothesis between stock repurchases and dividends. Brown et al. (2015) find that changes in dividends are negatively related to on-market repurchase yields. In other words, firms in Australia use the cash originally paid as dividends to increase on-market stock repurchase and the substituted relation holds well. The relationship between dividend variations and off-market repurchase yields are positive and significant. This implies that firms make more off-market stock repurchases when increasing dividends at the same time. They explain this inconformity by different tax executions in Australia towards on-market and off-market stock repurchase activities. On-market repurchases are taxed similarly with capital gains while off-market repurchases carry imputation tax credits the same as for dividends. Therefore, dividends are substitutes to on-market stock repurchases but complementary to off-market stock repurchases. Lastly, they add on-market and off-market repurchases and study the association between dividends and aggregate repurchases.

Jiraporn et al. (2011) investigate the effect of corporate governance on firms' dividend payments. They use ISS reports to capture qualities of governance on various dimensions. ISS includes broad governance measures, which consist of 62 specific standards on 8 different respects. These standards cover director education, management ownership, executive salary, broad composition, audit status, takeover defense, bylaws and other governance considerations. Jiraporn et al. use two proxies to scale the overall property of corporate governance for a firm. First, they create a composite index in which firms obtain one point when they satisfy a governance standard. The alternative is the ISS computed score that takes every governance standard into account. They find that firms with higher quality of corporate governance are more likely to pay dividends and the payments are much greater. Their robustness test, which employs two-stage least square estimation, shows that the positive relation is not derived from the causality of dividends to governance. They separately study the relationship between dividends and each governance aspect. Their results show that management ownership and executive salary are positively related to dividend payouts while takeover defense and bylaws are negatively associated. They discover that director education has little influence on corporate cash distributions. They also explore the impact of agency conflict on dividend-governance association and find that firms with severer information asymmetries have higher sensitivity of dividend payouts to corporate governance. They show that governance affects dividend payments for both regulated firms and non-regulated firms but the effect is more pronounced for the latter. They extend their research to investigate whether the governance effect varies with change of tax legislation but their analysis fails to support the argument that highly governed firms pay more dividends after a tax cut.

In recent years, firms have become accustomed to using stock repurchases to substitute for dividends as cash payouts. However, this substitution is affected by agency conflicts in the economy and existent literature suggests that employee stock options do matter. Kahle (2002) supposes that employee stock options affect corporate distribution on two dimensions. One is the ‘managerial wealth hypothesis’ that managers are partial to stock repurchases since dividends reduce the value of employee options. Without dividend protected policy, the exercise price of an option does not change while the stock price is decreased ex-dividend. The other is the 'option funding hypothesis' that managers prefer stock repurchases because they can offset new stock issues resulting from option exercise. Since most employee options in Taiwan are dividend protected, Wu et al. (2008) argue that this policy setting offers a useful environment to test the 'managerial wealth hypothesis'. They show that neither overall employee options nor particular executive options significantly affect firms' stock repurchases. Then, they split their sample into two: 'exercisable' and 'un-exercisable'. They find that only exercisable executive options are positively related to stock repurchases in favor of both the 'managerial wealth hypothesis' and the 'option funding hypothesis'. Additionally, they demonstrate that the adverse impact of employee options on dividend payouts is ambiguous when using Taiwanese data. They attribute this to the dividend protection of employee options that adjusts the exercise price. They test the signaling hypothesis of stock repurchase in Taiwan and discover that stock repurchases are used as a positive signal for future earnings only in the period before the emergence of employee options. After 2001, the time of the first employee option issue in Taiwan, the purpose of stock repurchases becomes to fund option exercises to avoid the EPS (earnings per share) being diluted.

Agency theory suggests that investor protection and corporate governance affect firms' cash distributions. Managers in civil law countries or with fewer constraints are less likely to pay dividends. Thus, what could investors expect if they confront this situation? He (2012) argues that competition in the product market is an efficient way to substitute investor protection and corporate governance. Japan, a nation with a high percentage of group firms, is considered as facing a serious agency problem and provides an ideal setting to test the function of the market competition mechanism. He (2012) finds that firms in a highly competitive market disgorge more cash than their counterparties. Moreover, his results show that firms facing tough competition are more willing to increase dividends while their incentive for omitting dividends is lower. He claims that market competition makes overinvesting risker and more easily observed and so reduces managers' willingness to proceed with negative net present value projects. However, this potency is weaker in the period of Japan's great recession. He next expands his study to the impact of market competition on the association between ownership concentration and dividend payouts. He discovers that the negative effect of concentration on dividends is less pronounced when there is market competition. This supports the hypothesis that market competition has the role of investor protection/corporate governance. In Japan, a considerable proportion of firms are affiliated with Keiretsu. On one hand, investors of Keiretsu firms are always group members, leading to convenient supervision and more dividend payments. On the other hand, group affiliation engages management to dominate firms totally, giving rise to weak minority shareholder protection and fewer cash disbursements. He (2012) shows that the influence of Keiretsu membership on dividend payment is mixed and ambiguous.

Fama and French (2000) study the issue of profitability and earnings forecasting. Although new technologies sometimes offer supernormal profitability in a particular industry, mimics will rapidly draw that down afterwards. Thus, it comes an argument that profitability is mean-reverting and to some extent can be predicted. Fama and French claim that prior evidence about this argument is insufficiently convincing. They use the Fama and MacBeth (1973) approach to forecast firms' earnings and profitability. This estimates results year-by-year using cross-sectional data and then calculates average slopes and time-series standard errors of them. They note that the approach is helpful in making use of large samples and allows residual cross-correlation. Their model shows that profitability is mean-reverting at almost 38 percent per year. Moreover, they find that the reversion is much stronger during the time profitability is far away from the mean, in both directions. Simultaneously, they find that earnings changes are mean-reverting as well, while positive changes reverse more weakly than negative changes. Finally, they indicate that the reason earnings can be forecast is because profitability is mean-reverting.

Chapter 3

How do credit default swaps affect the yield spread between corporate and Treasury bonds?

3.1 Introduction

Since the financial crisis that began in 2007, particular attention has been paid to credit derivatives, especially credit default swaps (CDSs). Stulz (2010) notes that the CDS market in the United States was largely developed during the previous ten years. According to the Bank for International Settlements, the CDS market in the United States increased dramatically from $6.4 trillion in 2004 to $58.24 trillion in 2007 then decreased to $12.29 trillion by the end of 2015 (www.bis.org). With this size volatility comes a need to understand the effect of CDS use on financial systems. Supporters claim that CDSs help creditors to lay off their risks and improve the efficiency of financial systems. For example, Greenspan (2004) concludes that credit derivatives contribute to a more efficient, resilient, and flexible financial system. Conversely, opponents argue that CDSs were partially responsible for the financial crisis. Indeed, even before the crisis, Partnoy and Skeel (2006) associated credit derivatives with the systemic risk of market collapse.

On the other hand, a large number of studies examine the effect of CDS from a corporate finance perspective. Ashcraft and Santos (2009) investigate the effect of CDS trading on corporate debt costs. However, they do not find strong evidence that CDSs impact the cost of corporate debt on average. Saretto and Tookes (2013) show that, after the onset of CDS trading, firms have higher leverage ratios and longer debt maturities. Subrahmanyam et al. (2014) argue that CDSs increase the credit risk of reference firms and creditors are inclined to push a distressed firm into bankruptcy after CDS trading. In this chapter, we investigate both theoretically and empirically the impact of CDSs on the yield spread between corporate and Treasury bonds following the introduction of CDS trading, discovering how these differ for firms with good or bad credits at bond issue times.

Why might the CDS market affect the yield spread between Treasury and corporate bonds? One mechanism generally assumed is that the CDS market permits capital lenders to lay off their credit risks, influencing the pricing of credit risk. There are both negative and positive routes for CDSs to impact the yield spread. A negative effect arises from the new hedging opportunity created by CDSs. With the introduction of CDS trading, investors can hedge against the default risks of reference firms, so corresponding risk premiums are erased. Thus, firms for which there is CDS trading are expected to have easier access to funding and can enjoy shrinkages of the yield spread. Positive effects arise in two ways. One is that CDSs generate the empty creditor problem. Creditors owning CDSs are insured against default but still have voting rights in the event of debt renegotiation making them "empty creditors" (Hu and Black, 2008). The separation of legal right and risk exposure changes the payoffs of creditors during financial distress. Bolton and Oehmke (2011) model this and predict that creditors with CDSs may be unwilling to agree to restructure the debt, even when it is efficient to do so, since they have an incentive to over-insure such that a large CDS position gives them more money in the event of default. The other is reduced incentive for banks to monitor borrowers. Parlour and Winton (2013) suggest that banks have reduced incentive to monitor borrowers if they can lay off their risk through buying credit default swaps. Both the empty creditor problem and reduced monitoring from banks would affect the risk of reference firms, leading to the yield spread increases after the onset of CDS trading.

In summary, once CDS trading becomes available, debt holders may require a lower return than previously from a corporate bond (because the CDS market creates a hedging opportunity) but, conversely, could require a higher return (due to changed credit quality of a reference firm). This means we cannot estimate directly the effect of CDSs on the yield spread without somehow distinguishing between the two directions. For this, we make use of the negative and positive effects performing differently under different conditions. To give us direction in our empirical investigation, we first develop a theoretical model of the yield spreads before and after the emergence of CDS trading. With this we show that the overall CDS effect should depend on a firm's credit when it issues bonds, leaving us to determine empirically whether the CDS effect varies with firms' credits. We find that the negative effect dominates the positive when firms issue bonds in their good credit periods but the positive effect dominates the negative during their bad credit periods. A rationale for this is that, during a good credit period, investors will pay a higher issue price for the bond because of the hedging opportunity provided by CDS trading but, during a bad credit period, investors pay a lower price because of the empty creditor problem and CDS trading results in a lack of monitoring. Punishment of the empty creditor problem is severer during times of credit deterioration, and the loss due to reduced monitoring is larger when a loan is in danger.

The rest of this chapter is organized as follows. Section 3.2 presents theoretical proofs for how the CDS availability affects the yield spread through the negative and positive channels. Section 3.3 describes data and gives the empirical specifications. Section 3.4 presents empirical results and analysis of the effect of CDS on the yield spread between corporate and Treasury bonds. Section 3.5 concludes.

3.2 Theoretical Framework

We next develop a theoretical structure to indicate how to approach an empirical investigation. We consider two scenarios: before the emergence of a CDS market and after the emergence, with the possibility of CDS trading. Before CDS trading, individuals can invest in two assets, a Treasury bond (risk-free) and a corporate bond. Use W to denote initial wealth, r_f for the risk-free rate, r for the interest rate of the corporate bond, p for the probability of default, l to denote the loss rate of initial wealth when a default event happens and U(x) for investors' utility function. If investors are risk averse, $U'(x)>0$ and $U''(x)<0$, and if they are indifferent between these two assets then for expected utility we have

$$U[W(1+r_f)] = pU[W(1+r-l)] + (1-p)U[W(1+r)]. \quad (3.1)$$

Taking a second order Taylor approximation of the right-hand side of equation (3.1) around $W(1+r_f)$ gives

$$p\{U[W(1+r_f)]+U'[W(1+r_f)][W(r-r_f-l)]+(1/2)U''[W(1+r_f)][W(r-r_f-l)]^2\} +$$
$$(1-p)\{U[W(1+r_f)]+U'[W(1+r_f)][W(r-r_f)]+(1/2)U''[W(1+r_f)][W(r-r_f)]^2\}. \quad (3.2)$$

Equating the left-hand and right-hand sides, we get

$$U'[W(1+r_f)][W(r-r_f)]-pU'[W(1+r_f)](Wl)+(1/2)U''[W(1+r_f)]\,[W(r-r_f)]^2-pU''[W(1+r_f)]W^2(r-r_f)l+(1/2)pU''[W(1+r_f)](Wl)^2 = 0. \quad (3.3)$$

Using s to denote $r-r_f$, u' to denote $U'[W(1+r_f)]$ and u'' to denote $U''[W(1+r_f)]$, we can simplify (3.3) to

$$(1/2)(u''W^2)s^2+(u'W-u''pW^2l)s+(1/2)u''p(Wl)^2-u'pWl = 0. \quad (3.4)$$

Solving equation (3.4), we find

$$r-r_f = s = pl + (-u'/u''W)\{1\pm[1+(u''/u')^2W^2l^2(p^2-p)]^{1/2}\}.$$

$1+(u''/u')^2W^2l^2(p^2-p)>0$, when $0<p<1$ is assumed here. Clearly, $\lim_{p\to 0} S = 0$ and $\lim_{p\to 1} S = l$ should hold, so

$$r = r_f + pl + (-u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p^2-p)]^{1/2}\}. \quad (3.5)$$

Since, $u'>0$, $u''<0$ and $0<p<1$, the last term $(-u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p^2-p)]^{1/2}\}>0$.

Now a CDS market emerges. CDS sellers ask an insurance price, f, per unit of wealth, W. Then the expected utility of a CDS seller is given by

$$U_{CDS\ SELLER} = pU[W(f-l)] + (1-p)U(Wf)\,. \quad (3.6)$$

Take a Taylor approximation of the left-hand side of equation (3.6) around 0. Assume that the CDS seller is risk neutral. Thus, all derivatives of order 2 and higher are equal to zero. Since credit default swaps break the separation between those willing to hold risk and those with capital, it is rational to assume bond holders are risk averse but CDS sellers are risk neutral. Equation (3.6) becomes

$$U_{CDS\ SELLER} = p\{U(0)+U'(0)[W(f-l)]\}+(1-p)[U(0)+U'(0)(Wf)]. \quad (3.7)$$

Assume there is a perfectly competitive CDS market. Thus, the profit approximates to 0. That means that $U_{CDS\ SELLER} = U(0)$. As a result, we obtain

$$P(f-l) + (1-p)f = 0 \quad (3.8)$$

$$\text{and } f = pl. \quad (3.9)$$

Now, we may first assume (only for a moment) that there only exist the negative but not the positive route for CDS availability to affect the yield spread. Thus, once CDS trading becomes available, individuals can invest in either the risk-free Treasury bond or a portfolio consisting of investing in a corporate bond and buying a CDS. Comparing equations (3.5) and (3.9), we find that individuals could exercise an arbitrage strategy of selling a Treasury bond and buying a corporate bond with CDS protection. This strategy makes an excess return of $(-u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p^2-p)]^{1/2}\}$ without risk. With the increasing demand for the corporate bond, the r continuously reduces until it is equal to r_f+pl. This is in accord with the theoretical equivalence derived by Duffie (1999) and the empirical findings of Blanco, Brennan and Marsh (2005).

If the assumption of only the negative CDS effect were true, we would find a decrease in the yield spread after the onset of CDS trading. Moreover, to some extent, firms should enjoy greater decrease when they issue bonds during a bad credit period than during a good credit period. However, empirical results are not in accord with this viewpoint. Ashcraft and Santos (2009) find that safer firms benefit more than riskier firms from the development of CDS markets. Actually, Subrahmanyam et al. (2014) have verified that the probability of default increases after CDS trading. This means that the onset of CDS trading has a positive effect on risk, increasing the default probability p. This proof implies that there is a trade-off for the yield spread between before and after CDS trading. The expected loss increases with the disappearance of $(-u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p^2-p)]^{1/2}\}$.

Using r_B to denote the interest rate of a corporate bond before CDS trading, r_A to denote the interest rate of a corporate bond after CDS trading, p_B to denote the default probability before CDS trading and p_A to denote the default probability after CDS trading with the same fundamentals, we obtain

$$r_B = r_f + p_B{*}l + (-u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{1/2}\} \quad (3.10)$$

$$r_A = r_f + p_A{*}l. \quad (3.11)$$

Thus, the difference between r_A and r_B depends on the sum of $(p_A - p_B)l$ and $(u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{1/2}\}$. Obviously, $(p_A - p_B)l$ is bigger than 0 and $(u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{1/2}\}$ is smaller than 0. In conclusion, the change in the spread is determined by the CDS effect on the probability of default when fundamentals do not change.

Since concerns about the empty creditor problem and less bank monitoring are relevant to pre-event risk, we assume $p_A = F(p_B)*p_B$. $F(x)$ should have four important properties. First, $F(x)$ should be bigger than 1 for $0<x<1$. In other words, the risk with the same fundamentals increases after CDS trading. Secondly, $\lim_{x \to 0} F(x)$ should be equal to one. This means that the CDS effect on the probability of default is very small when pre-event risk is small. Thirdly, $F'(x)$ should be bigger than 0 for $0<x<1$ and so higher initial risk induces a bigger CDS effect on risk. Fourthly, $F(x)$ should be convex in the interval of $(0,1)$ and this requirement ensures the increase speed of $F(x)$ rises with increasing x.

Make $g(p_B) = r_A - r_B = [F(p_B)-1]p_B l + (u'/u''W)\{1-[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{1/2}\}$. Taking the derivative of $g(p_B)$ with respect to p_B, we get

$$g'(p_B)=F'(p_B)p_B l + [(F(p_B)-1)l - (1/2)(u''/u')[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{-1/2}Wl^2(2p_B-1)] \quad (3.12)$$

Also

$$\lim_{pB\to 0} g'(pB)=(1/2)(u'/u'')Wl^2<0 \quad (3.13)$$

and

$$\lim_{pB\to 1/2} g'(pB)=(1/2)F'(1/2)l+[(F(1/2)-1]l>0. \quad (3.14)$$

Now, taking the second derivative of $g(p_B)$ with respect to p_B, we get

$$g''(p_B)= F''(p_B)p_B l+2F'(p_B)l-(1/2)(u''/u')Wl^2\{(-1/2)[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{-3/2} (u''/u')^2W^2l^2(2p_B-1)^2+2[1+(u''/u')^2W^2l^2(p_B^2-p_B)]^{-1/2}\}. \quad (3.15)$$

Using T to denote $[1+(u''/u')^2W^2l^2(p_B^2-p_B)]$ and A to denote $(u''/u')^2W^2l^2$, we simplify equation (3.15) to

$$g''(p_B)= F''(p_B)p_B l+2F'(p_B)l-(1/2)(u''/u')Wl^2T^{-1/2}\{2-A(2p_B-1)^2/[2+2A(p_B^2-p_B)]\}.$$

Equation (3.4) has solution and existing $g'(x)$ in (0,1), $A=(u''/u')^2W^2l^2$ should be smaller than 4. Thus, all the terms are bigger than 0 and always $g''(p_B) > 0$.

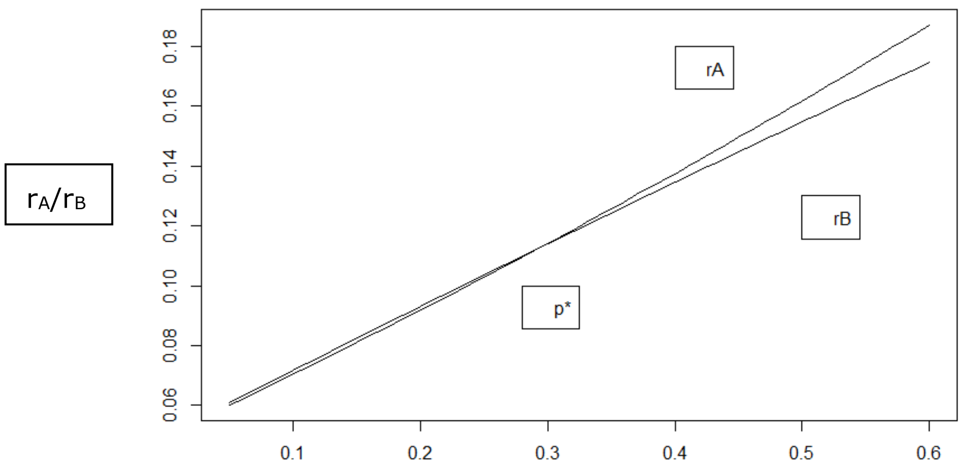
Recalling (3.13) and (3.14), we find there exists and only exists one value (p_0) in the interval (0,1/2) making $g'(p_0) = 0$. So, in the interval (0, p_0), $g'(p_B)<0$ and in the interval (p_0,1), $g'(p_B)>0$. Since $g(p_0)$ is the minimum that is smaller than 0 and

$\lim_{pB \to 1} g(pB)$=[F(1)-1]l>0, there exist and only exist one value (p*) in the interval (p_0,1) making g(p*)=0.

Consequently, when $p_B < p^*$, $g(x) = r_A - r_B < 0$ and when $p_B > p^*$, $g(x) = r_A - r_B > 0$. This means that the overall effect of CDS on the yield spread is determined by the trade-off of the negative effect and the positive effect of CDS. Thus, after the onset of CDS trading, when a firm issues bonds during a good credit period, it enjoys spreads shrinkage but when it issues bonds during a bad credit period, it sees expansion.

For simplicity, we assume $r_f = 0.05$, $l = 0.2$, $U(x) = \ln x$ and $F(x) = 1.25^x$. The following figure is obtained.

Figure 3.1 Return rates of a corporate bond before and after CDS trading



3.3 Empirical Specification and Data Description

3.3.1 Empirical specification

The goal of this chapter is to identify the effect of CDS use on the yield spread between corporate and Treasury bonds. Our theoretical framework shows how the overall CDS effect depends on a firm's credit when it issues bonds, so we must determine empirically whether the CDS effect varies with firms' credits. To do this, we create an interaction of CDS trading dummy and credit proxy. Afterwards, we separate good credit periods from bad credit periods by dividing the sample into subsamples. For investigating the negative impact, we split the data into 4 groups: good credit without CDS trading, good credit with CDS trading, no good credit without CDS trading and no good credit with CDS trading. Thus, we directly investigate the difference between group 2 and group 1, which is the benchmark. Similarly, for testing positive CDS impact, we split the sample into: bad credit without CDS trading, bad credit with CDS trading, no bad credit without CDS trading and no bad credit with CDS trading and compare the first two groups.

To identify whether the CDS effect varies with firms' credits, we apply the following model:

$$\underline{\mathit{Yield\ Spread}_{i,j,t} = c + a_1 \mathit{CDS\ Start}_{i,t} + a_2 \mathit{CDS\ Start}_{i,t} \times \mathit{Credit\ Proxy}_{i,t-1} + a_3 A_{i,t-1} + a_4 B_{j,t}}$$

$$\underline{+ a_5 C_t + a_6 \mathit{CDS\ Company}_i + v_{i,j,t}} \qquad (3.16)$$

The dependent variable is the yield spread, defined as the difference between returns of a corporate bond j at issue time t of the firm i and the Treasury with the same maturity as the bond. CDS $\mathrm{Start}_{i,t}$ is a dummy variable equals 1 for bonds issued by a reference firm i after the beginning date of the firm's CDS trading, 0 otherwise. We employ two indicators as credit proxy. The first indicator is the leverage (total liability over total assets) of firm i in the quarter just before issuing t-1. Leverage is a widely used proxy to measure the debt burden faced by a firm. Firms with high leverage ratios are more likely to be involved in financial distress and fail to pay their debts. Therefore, high leverage level implies high credit risk. The second indicator is the number converted from the credit rating of firm i in the quarter just before issuing t-1 (AAA = 1, AAA- = 1.33,…, C- = 9). The interaction of CDS $Start_{i,t}$ and Credit $Proxy_{it-1}$ shows that how CDS effect varies with a firm's credit information at issue. We include a CDS $Company_i$ dummy which equals 1 for CDS firms, 0 otherwise. This dummy is used to address the concern that CDS firms have time-invariant difference from non-CDS firms.

Both theoretical and empirical studies suggest that yield spreads are mainly driven by credit risk, so it is necessary to control for factors affecting that. A_{it-1} contains several variables to control credit risk in firm-specific level. These variables include Log Sales (natural log of the company's sales) to control the general risk of firms. A firm's sales reflect its ability in acquiring cash flow and repaying debt. Larger sales imply lower probability of failing to pay, so this variable should be negative with the yield spread. Leverage ratio (total liability over total assets) is included to control a firm's debt risk. Higher leverage needs to be compensated with higher the yield spread. Thus, the variable Leverage positively relates to the dependent variable. A_{it-1} also includes Profitability (net income over sales) and Rating (the firm's credit rating). Firms with high profitability are more likely to pay lower yield spreads. We employ firms' credit ratings because rating agencies are seen as owning private information on firms. Senior rating firms have lower yield spreads than junior firms. The variable Rating is the numbers linked to the firms' credit ratings. The conversion is AAA = 1, AAA- = 1.33,…, C- = 9. In summary, we include Log Sales (natural log of the company's sales), Leverage ratio (total liability over total assets), Profitability (net income over sales) and Rating (the firm's credit rating) as firm-specific controls. Moreover, we use cash flow as an extra firm-specific control for robustness check.

A set of variables for bond-specific characteristics $B_{j,t}$ is also taken into account in our model. These variables include Log Amount (natural log of the bond's issue amount), Log Maturity (natural log of the bond's maturity), and dummy variables to flag redeemable bonds (Redeemable), puttable bonds (Puttable), convertible bonds (Convertible) and bonds with some enhancement terms (Enhancement). If a bond is issued in large amount, that might induce high credit risk; conversely, it might be accompanied by the benefit of scale. Similarly, longer maturity bonds are often issued by good credit firms although longer maturity itself leads to high credit risk. In other words, the relationships between these two variables and the yield spread are uncertain. Since the embedded option to redeem has a negative value for lenders, so the dummy Redeemable should be positively related to the dependent variable. Conversely, bonds with the embedded put option normally have lower yield spreads. Convertible bonds give lenders the right to convert bonds to stocks on specific days, so these bonds tend to have lower yield spreads. Bonds with enhancement terms should carry lower yield spreads since enhancement terms reduce the credit risk of firms.

Our model further considers the impact of timing on the yield spread. A series of time dummies, C_t, (one for each quarter) are included in the specification. Several factors such as growth in the economy, monetary policy and risk preference of lenders vary over time and impact on the yield spread.

To separate the negative CDS effect from the positive effect, we apply the following model:

$$\underline{\textit{Yield Spread}_{i,j,t} = c + a_1 \textit{Good}_{i,t-1}\&\textit{CDS Start}_{i,t} + a_2 \textit{No Good}_{i,t-1}\&\textit{No CDS Start}_{i,t} + a_3 \textit{No Good}_{i,t-1}\&\textit{CDS Start}_{i,t} + a_4 A_{i,t-1} + a_5 B_{j,t} + a_6 C_t + a_7 \textit{CDS Company}_i + v_{i,j,t}} \quad (3.17)$$

$$\underline{\textit{Yield spread}_{i,j,t} = c + a_1 \textit{Bad}_{i,t-1}\&\textit{CDS Start}_{i,t} + a_2 \textit{No Bad}_{i,t-1}\&\textit{No CDS Start}_{i,t} + a_3 \textit{No Bad}_{i,t-1}\&\textit{CDS Start}_{i,t} + a_4 A_{i,t-1} + a_5 B_{j,t} + a_6 C_t + a_7 \textit{CDS Company}_i + v_{i,j,t}} \quad (3.18)$$

Yield $\text{spread}_{i,j,t}$, $A_{i,t-1}$, $B_{j,t}$, C_t, and CDS Company_i are defined as before. $\text{Good}_{i,t-1}$&CDS $\text{Start}_{i,t}$ equals 1 if a bond is issued after CDS trading and during good credit periods, 0 otherwise. No $\text{Good}_{i,t-1}$&No CDS $\text{Start}_{i,t}$ equals 1 for a bond issued without CDS trading and during no good credit periods, 0 otherwise. No $\text{Good}_{i,t-1}$&CDS $\text{Start}_{i,t}$ equals 1 for a bond issued after CDS trading and during no good credit periods, 0 otherwise. $\text{Bad}_{i,t-1}$&CDS $\text{Start}_{i,t}$, No $\text{Bad}_{i,t-1}$&No CDS $\text{Start}_{i,t}$ and No $\text{Bad}_{i,t-1}$&CDS $\text{Start}_{i,t}$ are defined similarly to their "Good" counterparts. We use leverage and the credit rating expressed numerically (AAA=1, etc.) as two credit proxies to distinguish good/bad and no good/no bad credit periods. A good/bad period is the time when a firm's credit proxy is smaller/bigger than the selected level of that proxy.

All our models are estimated by (1) OLS with robust standard errors and clustered by firm; (2) OLS with robust standard errors and firm fixed effects; (3) OLS controls industry fixed effects and clusters standard error at the firm level.

3.3.2 Data description

We employ three databases: Compustat, Mergent-FISD and Markit. To start with, we need to know which firms referenced by credit default swaps and the timing of inception of CDS trading. We obtain daily CDS quotes from the Markit CDS database. Markit is a widely used source for dealer quotes of credit default swaps from January 2001 onwards. We select all firms that have CDS quotes and use the first CDS appearance date of a firm, denominated in US dollars and having five years maturity, as the start of CDS trading for that firm. The sample period is from January 2001 to December 2014. Fundamental information for firms comes from the Compustat quarterly database. Compustat contains financial, market, and statistical data of most North America firms and provides our research several firm-specific features. Since the financial sector is seen as different from other economic sectors, we consider only non-financial firms. All firms are required to have no missing values for all interested variables. To exclude the impact of outliers, we windsorize all interested variables at the 1th and 99th percentiles. The bond-specific data such as bond yields, maturity, issue amount and a variety of bond characteristics are acquired from the Mergent fixed investment securities database (FISD). Similarly, we require that all bonds have no missing values for any variable of interest. Bonds with all required firm-specific and bond-specific information are obtained to construct our sample. Moreover, if a reference firm's bonds are all issued before or after the onset of its CDS trading, we remove all the bonds of that firm. We limit our sample to bonds issued when firms' credit ratings are no worse than C-. In the end, we obtain 6454 bonds issued by 1300 firms in which 346 firms are referenced by credit default swaps.

Table 3.1 Summary Statistics

variables	CDS $Start_{i,t}$=0 vs CDS $Start_{i,t}$=1		
	CDS $Start_{i,t}$=0	CDS $Start_{i,t}$=1	Difference
Log Sales	6.373888	7.835319	1.461431***
Leverage	0.667543	0.652157	-0.015386***
Profitability	0.038301	0.069238	0.030937***
Log Amount	12.08985	13.01167	0.92182***
Log Maturity	2.331337	2.284804	-0.046533***
Rating(%)			
AAA	0.019703	0.019626	-7.70E-05
AA- ~ AA+	0.081826	0.07243	-0.009396
A- ~ A+	0.237134	0.28271	0.045576***
BBB- ~ BBB+	0.289754	0.424299	0.134545***
BB- ~ BB+	0.153222	0.12757	-0.025652***
B- ~ B+	0.103848	0.067757	-0.036091***
CCC- ~ CCC+	0.005332	0.003271	-0.002061
CC	0.001391	0	-0.001391*
Unrated	0.10779	0.002337	-0.105453***
Spread	193.6716	213.5465	19.8749***
Number of observations	4314	2140	6454

Log Sales: natural log of the firm's sales. Leverage: total liability over total assets. Profitability: net income over sales). Log Amount: natural log of the bond's issue amount. Log Maturity: natural log of the bond's maturity. Rating: the firm's long-term credit rating. Spread: ex ante bond yield over Treasury with the same maturity. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.1 separately gives summary statistics for groups with CDS $Start_{i,t}$=0 and CDS $Start_{i,t}$=1. Comparing these two groups can provide some insights. The result shows that natural log of sales is a little higher for the group with CDS $Start_{i,t}$=1. This implies that bond issue firms have better performances after the onset of CDS trading. Leverage slightly decreases after the start of CDS trading. This is contrary to the finding of Saretto and Tookes (2013) but in accord with that of Ashcraft and Santos (2009). The reason could be that the former focuses on firms in the S&P 500 index that often stay at good credit levels rather than bond issue firms. There is a high increase of profitability after CDS start. This is not surprising because CDS sellers are more likely to sign a contract when reference firms are profitable. After CDS trading, natural log of the bonds' issue amounts increase a lot while that of maturities decrease with a small portion. In the group with CDS $Start_{i,t}$=0, about 63 percent of bonds are issued when firms' credit ratings are better than BBB. However, in the group with CDS $Start_{i,t}$=1, that number is increased to 80 percent. The probability of unrated firms after introducing CDS is close to 0. These two are consistent with claims of Arentsen et al. (2015) that credit default swaps are often traded when reference firms have investment-grade ratings. Similar to the findings of Ashcraft and Santos (2009), the yield spreads are increased after CDS trading, perhaps due to the "empty creditor" problem and a lack of bank monitoring.

3.4 Empirical Results

In this section, we present empirical findings with regard to the CDS effect on the yield spread between corporate and Treasury bonds. Since the effect could vary with an issuer's credit information at issue time, credit proxies must be taken into consideration. We employ leverage and the credit rating expressed numerically (AAA=1, etc.) as proxies and show results separately based on these two different proxies.

3.4.1 Does CDS effect vary with the company's credit risk on issue time?

Table 3.2 Does CDS effect vary? Use leverage as the credit proxy

VARIABLES	(1)	(2)	(3)
Log Sales	-27.75***	-6.865*	-36.28***
	(2.401)	(3.543)	(3.057)
Profitability	-195.7***	-105.5***	-167.8***
	(19.66)	(12.15)	(20.76)
Leverage	51.18**	82.86***	63.45***
	(21.64)	(17.38)	(21.38)
Rating	33.12***	10.74***	22.14***
	(2.018)	(1.539)	(2.088)
Log Amount	14.17***	9.875***	8.576***
	(2.688)	(2.616)	(2.966)
Log Maturity	-1.759	12.43***	1.425
	(3.110)	(2.268)	(2.619)
Enhancement	25.64***	-7.191	2.497
	(9.531)	(5.936)	(8.721)
Convertible	-212.0***	-192.3***	-219.7***
	(13.71)	(15.42)	(15.69)
Redeemable	4.810	-0.365	-1.128
	(5.607)	(4.446)	(5.992)
Puttable	-14.70	-23.38**	-4.362
	(9.654)	(10.29)	(9.051)
CDS Start	-122.9***	-99.08***	-140.9***
	(26.27)	(15.44)	(25.03)
CDS Start × Leverage	144.8***	151.6***	166.0***
	(40.28)	(21.26)	(38.65)
CDS Company	-1.483		4.309
	(6.534)		(7.022)
Constant	3.318	-44.74	-190.3***
	(38.05)	(75.95)	(45.07)
Firm Fixed Effect	No	Yes	No
Industry Fixed Effect	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes
Observations	6,358	6,358	6,358
R-squared	0.568	0.825	0.663

Column (1) is estimated with robust standard error and clustered by company. Column (2) is estimated with robust standard error and firm-fixed effects. Column (3) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS start: dummy variable that is equal to one for bonds after the beginning date of the firm's CDS trading. Rating is the number linked to the firm's credit rating. The conversion is AAA = 1, AAA- = 1.33,…, C- = 9. Log Amount: natural log of the bond's issue amount. Log Maturity: natural log of the bond's maturity. Enhancement: bonds with some enhancement terms. Convertible: convertible bond. Redeemable: redeemable bonds. Puttable: bonds with put option. See table 1 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.2 presents results when using leverage as the credit proxy. As expected and shown in section 3.3.1, firms have larger sales, higher profitability and better credit rating lower the yield spread. Issue amount for a bond does increase the yield spread whereas evidence of a bond's maturity contributing to the raising of the yield spread is inconclusive. Convertible bonds enjoy lower yield spreads. Some bond-specific variables (redeemable, puttable and enhancement) are statistically not significant in general. A reasonable explanation could be that our sample is not very large and bonds with these features are few. Our main interests are coefficients on dummy CDS $Start_{i,t}$ and the interaction of CDS $Start_{i,t}$ and Credit $Proxy_{i,t-1}$. All 3 regressions (columns 1,2,3) show that coefficients on dummy CDS $Start_{i,t}$ are negative and statistically significant at 1% confidence level whereas coefficients on the interaction of CDS $Start_{i,t}$ and $Leverage_{i,t-1}$ are positive and statistically significant at 1% level. These results verify our assumption that the CDS effect varies with the firm's credit risk at issue time. Taking the derivative of equation (3.16) with respect to CDS $Start_{i,t}$, we get ∂yield $spread_{i,j,t}/\partial$CDS $Start_{i,t} = a_1 + a_2 Leverage_{i,t-1}$. The negative a_1 tells us that after CDS trading, firms may enjoy lower the yield spread when issuing bonds during extremely good credit periods. However, positive a_2 implies the CDS effect would turn from negative to positive with the increase of the credit risk (leverage). Thus, the overall effect of CDS on the yield spread depends on the credit risk of the firm when it issues bonds. This finding is consistent with the illustration in section 3.2.

Table 3.3 Does CDS effect vary? Use credit rating numbers (AAA=1, etc.) as the credit proxy.

VARIABLES	(1)	(2)	(3)
Log Sales	-23.79***	-8.017**	-33.97***
	(2.560)	(3.386)	(3.044)
Profitability	-195.6***	-103.3***	-165.4***
	(19.45)	(11.66)	(20.05)
Leverage	62.86***	102.2***	85.12***
	(18.26)	(14.55)	(18.55)
Rating	27.80***	6.881***	19.23***
	(1.951)	(1.489)	(2.049)
Log Amount	15.39***	9.750***	8.904***
	(2.597)	(2.510)	(3.038)
Log Maturity	-2.018	14.13***	3.140
	(2.897)	(2.176)	(2.556)
Enhancement	9.448	-16.81***	-7.376
	(9.273)	(5.716)	(8.541)
Convertible	-188.8***	-168.9***	-202.0***
	(12.62)	(14.82)	(15.01)
Redeemable	1.396	-0.720	-2.542
	(5.629)	(4.251)	(5.474)
Puttable	-21.73**	-22.95**	-7.920
	(9.457)	(9.878)	(9.054)
CDS Start	-253.0***	-238.8***	-246.2***
	(28.86)	(12.29)	(23.07)
CDS Start × Rating	57.96***	61.08***	55.04***
	(7.003)	(2.783)	(5.835)
CDS Company	-13.31**		-5.158
	(6.481)		(7.163)
Constant	-19.84	-55.46	-224.3***
	(36.05)	(72.80)	(44.61)
Firm Fixed Effect	No	Yes	No
Industry Fixed Effect	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes
Observations	6,358	6,358	6,358
R-squared	0.592	0.839	0.678

Column (1) is estimated with robust standard error and clustered by company. Column (2) is estimated with robust standard error and firm-fixed effects. Column (3) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS start: dummy variable that is equal to one for bonds after the beginning date of the firm's CDS trading. Rating is the number linked to the firm's credit rating. The conversion is AAA = 1, AAA- = 1.33,…, C- = 9. Log Amount: natural log of the bond's issue amount. Log Maturity: natural log of the bond's maturity. Enhancement: bonds with some enhancement terms. Convertible: convertible bond. Redeemable: redeemable bonds. Puttable: bonds with put option. See table 1 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.3 presents results from the same approach but using the credit rating expressed numerically (AAA=1, etc.) as the credit proxy. Coefficients on CDS $Start_{i,t}$ in all 3 columns use the same symbol with the significance as findings observed in table 3.2. Coefficients on interaction of CDS $Start_{i,t}$ and $Rating_{i,t-1}$ suggest that CDS effect positively varies with the credit rating expressed numerically (AAA=1, etc.) for all 3 different estimations. Results from table 3.3 imply that, after CDS trading, the yield spread decreases when the firm issues bonds with a good credit rating but increases with a bad credit rating at time of issue. These findings confirm our previous assumptions and analyses.

3.4.2 Separating good credit periods from bad credit periods

Our empirical results show that the CDS effect indeed varies with firms' credit information at issue dates. However, we do not know whether the negative effect outweighs the positive during good credit periods and the positive effect is dominant during bad credit periods. To address this, we divide our sample to 4 groups to investigate either the negative or positive CDS effect. Moreover, this approach eliminates the concern of correlation between CDS $Start_{i,t}$ and CDS $Start_{i,t}$ multiplied by Credit $proxy_{i,t-1}$.

Table 3.4 Detailed statistical summary for leverage in the sample

	Leverage			
	Percentiles	Smallest		
1%	0.2463452	0.0363191		
5%	0.4220801	0.1156367		
10%	0.4774439	0.1323362	Obs	6358
25%	0.5699214	0.1662572	Sum of Wgt.	6358
50%	0.6698778		Mean	0.696665
		Largest	Std. Dev.	0.234211
75%	0.7775905	2.348285		
90%	0.8814926	2.364728	Variance	0.054855
95%	1.09326	2.364728	Skewness	2.194365
99%	1.592987	2.364728	Kurtosis	11.91719

This is the detailed statistic summary for leverage in our sample.

The method we use to divide our sample is illustrated in section 3.3.1. Leverage and the credit rating expressed numerically (AAA=1, etc.) are used as two credit indicators to distinguish whether a firm is during a good or bad credit period. Table 3.4 presents a detailed statistical summary of the variable Leverage. We find that the 10 percent quartile of leverage in our sample is 0.48 and the 90 percent quartile is 0.88. Therefore, we define that: if a firm has leverage less than 0.5 at time of issue, bonds are considered as issued during a good credit period. We select the leverage of 0.5 because it is not only close to the 10 percent quartile, but also the ratio for net assets to liability is greater than 1 and so the guarantee is sufficient. Correspondingly, if a firm has leverage more than 0.88 at time of issue, bonds are considered as issued during bad credit periods.

When using the credit rating expressed numerically (AAA=1, etc.) as indicator, we do not employ quartiles of the number in our sample to identify whether a firm is during a good or a bad period. The reason is that these numbers are discontinuous, so quartiles cannot be reliable criteria. We define bonds as issued during good credit periods when firms have an A- credit rating or better at issue time. Nevertheless, at issue time, when firms have a BB+ credit rating or worse (no investment grade), bonds are viewed as issued during bad credit periods.

To investigate the negative effect, the sample is divided into $Good_{i,t-1}$&No CDS $Start_{i,t}$, $Good_{i,t-1}$&CDS $Start_{i,t}$, No $Good_{i,t-1}$&No CDS $Start_{i,t}$ and No $Good_{i,t-1}$&CDS $Start_{i,t}$. The benchmark group is $Good_{i,t-1}$&No CDS $Start_{i,t}$ and the interest of our analysis is the difference between $Good_{i,t-1}$&CDS $Start_{i,t}$ and the benchmark. Similarly, for finding the positive effect, we divide our sample to $Bad_{i,t-1}$&No CDS $Start_{i,t}$, $Bad_{i,t-1}$&CDS $Start_{i,t}$, No $Bad_{i,t-1}$&No CDS $Start_{i,t}$ and No $Bad_{i,t-1}$&CDS $Start_{i,t}$. The benchmark is $Bad_{i,t-1}$&No CDS $Start_{i,t}$ and we focus on group $Bad_{i,t-1}$&CDS $Start_{i,t}$ relative to the benchmark.

Table 3.5 The CDS effect on the yield spread using leverage as the indicator

	The Yield Spread					
	Negative CDS Effect			Positive CDS Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	-43.52***	-8.95	-55.29***			
	(12.42)	(10.87)	(13.58)			
No Good & No CDS Start	-24.75***	-12.68	-20.70**			
	(10.27)	(7.985)	(9.49)			
No Good & CDS Start	-49.85***	-7.828	-48.14***			
	(12.65)	(9.301)	(11.95)			
Bad & CDS Start				81.53***	91.68***	64.88***
				(30.8)	（13.46）	（14.02）
No Bad & No CDS Start				-15.61	-1.448	-8.311
				（15.77）	（10.3）	（9.201）
No Bad & CDS Start				-50.19***	-5.291	-44.93***
				（17.87）	（11.57）	（10.43）
CDS Company	-0.383		5.071	-1.496		4.101
	(6.684)		(7.165)	（6.539）		（4.594）
Constant	-1.32	-68.67	-201.54***	27.26	-52.72	-187.2
	(38.3)	(76.26)	(45.8)	（45.48）	（77.8）	（120.4）
Firm Fixed Effect	No	Yes	No	No	Yes	No
Industry Fixed Effect	No	No	Yes	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6358	6358	6358	6358	6358	6358
R-squared	0.566	0.823	0.66	0.572	0.826	0.664

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. Good & CDS start: dummy variable that equals one for bonds issued after CDS trading and during good credit periods. No Good & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no good credit periods. No Good &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no good credit periods. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. See table 1 and 2 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.5 shows results of the negative and positive CDS effects using leverage as the credit proxy. To save space, we only report coefficients that we are interested in. However, these models include all controls considered in section 3.4.1, as do later models. Coefficients on $Good_{i,t-1}$&CDS $Start_{i,t}$ in column 1 and 3 are negative and statistically significant at 1% confidence level. This means that the yield spread decreases after CDSs begin to trade when bonds were issued during good credit periods. A surprising finding is that the coefficients on other two groups are also significantly negative in columns 1 and 3. A probable reason is that bond buyers do not think lower leverage level can be an ideal indicator for lower credit risk. In contrast with the ambiguous results of the negative effect, findings from columns (4), (5) and (6) are explicit. All coefficients on $Bad_{i,t-1}$&CDS $Start_{i,t}$ in three columns are positive and statistically significant at 1% confidence level. It is obvious that under the condition of issuing bonds during bad credit periods, yield spreads of bonds issued after CDS trading are higher. This verifies our assumption that firms after CDS begin to trade are punished when issue bonds during bad credit times.

Table 3.6 The CDS effect on the yield spread using credit rating numbers (AAA=1, etc.) as the indicator

	The Yield Spread					
	Negative CDS Effect			Positive CDS Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	-70.71***	-51.27***	-74.35***			
	(10.43)	(7.339)	(9.459)			
No Good & No CDS Start	3.953	-3.271	-8.498			
	(7.602)	(6.338)	(8.533)			
No Good & CDS Start	-2.252	23.99***	-18.12			
	(11.28)	(7.857)	(11.63)			
Bad & CDS Start				54.41***	98.70***	49.64***
				(14.72)	(8.004)	(14.33)
No Bad & No CDS Start				-111.8***	-26.82***	-74.85***
				(9.516)	(7.73)	(9.784)
No Bad & CDS Start				-155.9***	-52.35***	-123.3***
				(12.07)	(8.518)	(11.71)
CDS Company	-5.895		0.438	-6.188		-0.0856
	(6.566)		(7.209)	(6.229)		(6.799)
Constant	-18.49	-80.3	-209.1***	193.9***	-5.567	-100.2**
	(37.98)	(75.04)	(46.29)	(36.28)	(74.31)	(44.00)
Firm Fixed Effect	No	Yes	No	No	Yes	No
Industry Fixed Effect	No	No	Yes	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6358	6358	6358	6358	6358	6358
R-squared	0.573	0.829	0.665	0.621	0.836	0.687

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. Good & CDS start: dummy variable that equals one for bonds issued after CDS trading and during good credit periods. No Good & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no good credit periods. No Good &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no good credit periods. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. See table 1 and 2 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

As a robustness test, we change the credit proxy to the number converted from credit rating. It seems that these numbers are more effective than leverage as the credit proxy, especially during a good credit period. Table 3.6 shows that coefficients on $Good_{i,t-1}$&CDS $Start_{i,t}$ in column 1, 2 and 3 are all negative and statistically significant at 1% confidence level. This confirms our earlier results that CDSs do lead to decrease in the yield spread as long as bonds are issued with high credit rating of firms at issue time. Columns (4), (5) and (6) suggest that $Bad_{i,t-1}$&CDS $Start_{i,t}$ is positively related to the yield spread and its coefficients are statistically significant at 1% confidence level. This indicates that bonds issued after CDS trading begins have larger yield spreads when firms have worse credit ratings at times of issue. During bad credit periods, yield spreads of bonds issued after CDSs begin to trade increase 50-100 basis points relative to those of bonds issued before and bonds of non-CDS firms. These are quite large economically. Coefficients on No $Bad_{i,t-1}$&No CDS $Start_{i,t}$ and No $Bad_{i,t-1}$&CDS $Start_{i,t}$ are significantly negative, implying that these two groups have lower yield spreads compared to the benchmark group.

3.4.3 Potential Endogeneity

Results displayed in section 3.4.1 and 3.4.2 clearly demonstrate both negative and positive CDS effects on the yield spread. However, the estimation method we use is ordinary least squares (OLS), which strictly requires the covariance of the estimation error and regressors equals to zero. This condition may not be satisfied because we do not know whether the timing of CDS trading onset is exogenous or not. It is probable that CDS trading begins while market participants predict the future changes of the yield spread. Thus, a potential endogeneity problem arises and must be taken into consideration. We follow Ashcraft and Santos (2009) and Subrahmanyam et al. (2014) using propensity score matching to find a matched sample and address the problem.

3.4.3.1 Propensity score matching

Propensity score matching is one of the most popular methods to solve an endogeneity problem because of its simple matching methodology (Roberts and Whited, 2012). In contrast with the exact matching approach, propensity score matching only depends on one dimension, that is the propensity score. The former becomes very complicated when there are many covariate Xs or several of the covariates have many different values. Given a series of covariate Xs, the propensity score is viewed as the conditional probability of receiving treatment. The propensity score is a scalar although Xs is a vector represents many characteristics. Rosenbaum and Rubin (1983) note that if the treatment and potential outcomes are mutually independent of each other conditional on covariates, they are mutually independent conditional on the propensity score.

Observational data are always non-randomized and the application of propensity score matching helps to change this situation. In identifying a treatment effect, to avoid self-selection bias, scholars need to compare treated observations with untreated ones that have very similar characteristics. However, this sort of untreated observation is not ready-made. We find them by estimating propensity scores and matching untreated observations to treated. Thus, problems of non-randomized data and potential endogeneity are addressed. The difference of underlying outcomes (such as the yield spread) between the treated and the matched sample is the pure treatment impact.

3.4.3.2 Finding a matched sample

We identify a matched sample in which firms are not referenced by CDSs but have similar features to CDS firms by p score matching. Data from the first quarter of 2001 to the first quarter of each CDS trading are used for CDS reference firms and for non-CDS firms we include all data throughout our sample period. A probit model is employed to investigate the coefficient on each covariate for receiving CDS trading. These covariates contain Log Assets (natural log of the company's total assets), Log Sales (natural log of the company's sales), Leverage (total liability over total assets), Profitability (net income over sales), Rating (the company's credit rating), ROA (income divide total assets), PPENT (property, plant and equipment over total assets), RE (retained earnings over total assets), Rated (equals 1 for rated company) and IG (equals 1 for investment grade company). The dependent variable is binary, equaling 0 before the inception of CDS trading and 1 thereafter. For non-CDS companies, this dependent variable is always equal to 0. We then use the estimated coefficients getting from the probit model to predict the propensity scores.

The implementation of matching is based on propensity scores obtained beforehand. For each CDS firm, we identify one non-CDS firm that has a bond issue record and is the nearest neighbor. Replacement is allowed in choosing the nearest neighbor. This means that a non-CDS firm may be matched to more than one CDS firm if it is the nearest neighbor for all of them. A caliper of 0.01 is used in the matching. Any CDS firm for which we cannot find a nearest neighbor within the distance of 0.01 is removed from the sample.

3.4.4 Results using the p score matched Sample

Table 3.7 P score matched sample using leverage as the indicator

	The Yield Spread					
	Negative CDS Effect			Positive CDS Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	0.363	-1.44	-10.99			
	（14.48）	（11.99）	（13.79）			
No Good & No CDS Start	-24.19*	-9.326	-14.32			
	（13.64）	（9.595）	（12.78）			
No Good & CDS Start	-6.86	2.052	-5.642			
	（16.19）	（10.83）	（14.36）			
Bad & CDS Start				105.9***	76.03***	90.58**
				（39.29）	（16.51）	（37.99）
No Bad & No CDS Start				-32.15	-15.72	-22.18
				（26.63）	（14.00）	（24.30）
No Bad & CDS Start				-24.51	-12.13	-22.31
				（28.6）	（15.08）	（25.09）
CDS Company	2.192		-7.307	3.39		-5.881
	（9.171）		（8.575）	（9.03）		（8.385）
Constant	-20.86	1.592	145.6***	37.34	32.41	176.2***
	（48.98）	（79.59）	（55.91）	（61.32）	（82.35）	（60.52）
Firm Fixed Effect	No	Yes	No	No	Yes	No
Industry Fixed Effect	No	No	Yes	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,521	3,521	3,521	3,521	3,521	3,521
R-squared	0.567	0.763	0.68	0.576	0.766	0.686

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Good & CDS start: dummy variable that equals one for bonds issued after CDS trading and during good credit periods. No Good & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no good credit periods. No Good &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no good credit periods. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. See table 1 and 2 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

We re-estimate the negative and positive CDS effects with a propensity score matched sample. The variables of interest are still $Good_{i,t-1}$&CDS $Start_{i,t}$ for good credit periods and $Bad_{i,t-1}$&CDS $Start_{i,t}$ for bad credit periods. Using the propensity score matched sample, we gauge the CDS impact either negative or positive by the difference between CDS and matched non-CDS firms that have similar probability of receiving CDS trading.

Table 3.7 shows results of the negative and positive CDS effects with the propensity score matched sample using leverage as the credit proxy. When the leverage of an issuer is under 0.5 at the time of issue, its bonds are viewed as issued during good credit periods. When using the matched sample, coefficients on $Good_{i,t-1}$&CDS $Start_{i,t}$ for column 1, 2 and 3 become statistically insignificant. This again verifies that leverage is not a perfect proxy for credit when it is in lower levels. When the leverage of an issuer is over 0.88 at issue time, their bonds are viewed as issued during bad credit periods. All coefficients on $Bad_{i,t-1}$&CDS $Start_{i,t}$ in three columns are positive and statistically significant at 5% or 1% confidence level. This means that, under the condition of issuing bonds during bad credit periods, yield spreads of bonds issued after CDS trading are higher than those of bonds issued by matched non-CDS firms. There is a punishment for CDS firms when they issue bonds with higher leverage ratios.

Table 3.8 P score matched sample using credit rating numbers (AAA=1, etc.) as the indicator

	The Yield Spread					
	Negative CDS Effect			Positive CDS Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	-32.13***	-41.77***	-32.36***			
	(10.69)	(8.512)	(9.486)			
No Good & No CDS Start	5.864	-8.383	-3.468			
	(9.005)	(8.1)	(9.732)			
No Good & CDS Start	42.59***	25.46***	20.38*			
	(12.35)	(9.602)	(12.28)			
Bad & CDS Start				94.02***	94.23***	84.75***
				(17.47)	(9.031)	(15.94)
No Bad & No CDS Start				-104.8***	-32.81***	-77.91***
				(12.52)	(9.518)	(13.46)
No Bad & CDS Start				-115.0***	-50.22***	-92.90***
				(15.32)	(10.20)	(14.17)
CDS Company	0.219		-8.081	-5.477		-8.747
	(9.115)		(8.797)	(7.970)		(7.740)
Constant	-36.98	-22.09	115.7**	169.4***	38.99	247.7***
	(49.23)	(78.18)	(56.95)	(41.74)	(76.48)	(49.49)
Firm Fixed Effect	No	Yes	No	No	Yes	No
Industry Fixed Effect	No	No	Yes	No	No	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,521	3,521	3,521	3,521	3,521	3,521
R-squared	0.581	0.771	0.686	0.646	0.783	0.722

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Good & CDS start: dummy variable that equals one for bonds issued after CDS trading and during good credit periods. No Good & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no good credit periods. No Good &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no good credit periods. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. See table 1 and 2 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

The credit rating expressed numerically (AAA=1, etc.) is also used as the credit proxy to investigate CDS effects with the propensity score matched sample. Table 3.8 shows CDS impacts both during good and bad credit periods using the matched sample. If a firm has an A- credit rating or better at issue time, bonds are considered as issued during good credit periods. Similar to findings in table 3.6, $Good_{i,t-1}$&CDS $Start_{i,t}$ is negatively correlated with the yield spread and its coefficients are statistically significant at 1% confidence level. This suggests that bonds issued after CDS trading have lower yield spreads compared with bonds issued by matched non-CDS firms when issuers have better credit ratings. Coefficients on CDS $Company_i$ dummy are insignificant suggested by estimations 1 and 3. If a firm has a BB+ credit rating or worse at issue, bonds are viewed as issued during bad credit periods. Unsurprisingly, all coefficients on $Bad_{i,t-1}$&CDS $Start_{i,t}$ in column 4, 5 and 6 are positive and statistically significant at 1% confidence level. These coefficients show that with lower credit ratings, yield spreads of bonds issued by CDS firms, after CDS trading, increase 85-95 basis points relative to those of bonds issued by non-CDS firms with similar probability of receiving CDS trading.

3.4.5 Does the liquidity of CDS market matter?

The impact of CDSs on the yield spread depends on how liquid a CDS market is. Without a high liquid CDS market, bond buyers cannot hedge their risks at lower cost level and some basic assumptions in our study are undermined. Since CDSs' liquidities are different among our sample, whether CDSs with high liquidities are distinguishing from those with low liquidities becomes an interesting question. We re-estimate equation 3.17 and 3.18 with different liquidities and display results in table 3.9 and 3.10.

Table 3.9 The negative CDS impact on the yield spread with different CDS liquidity

Dependent variable:	Negative CDS Effect					
The Yield Spread	High Liquidity	Low Liquidity	High Liquidity	Low Liquidity	High Liquidity	Low Liquidity
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	-76.85***	-1.117	-45.73***	12.35	-92.19***	-1.825
	(12.62)	(17.79)	(9.534)	(24.74)	(12.07)	(20.99)
No Good & No CDS Start	14.99**	11.03	18.54***	22.62**	3.123	2.285
	(7.512)	(11.65)	(6.860)	(11.35)	(8.545)	(12.32)
No Good & CDS Start	3.937	65.66***	62.31***	41.45*	-14.74	34.53
	(13.70)	(19.83)	(10.05)	(21.98)	(14.03)	(21.79)
CDS Company	-4.459	-6.28			2.145	-4.43
	(6.693)	(16.87)			(7.529)	(19.76)
Constant	9.547	-9.589	-43.34	-183.6*	-201.1***	-126.4*
	(38.04)	(53.90)	(74.88)	(97.40)	(46.74)	(70.11)
Firm Fixed Effect	No	No	Yes	Yes	No	No
Industry Fixed Effect	No	No	No	No	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
R Square	0.584	0.578	0.857	0.880	0.676	0.683
Observation	5,198	3,693	5,198	3,693	5,198	3,693

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Good & CDS start: dummy variable that equals one for bonds issued after CDS trading and during good credit periods. These regressions include all controls considered in section 3.4.1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.10 The positive CDS impact on the yield spread with different CDS liquidity

Dependent variable:	Positive CDS Effect					
The Yield Spread	High Liquidity	Low Liquidity	High Liquidity	Low Liquidity	High Liquidity	Low Liquidity
	(1)	(2)	(3)	(4)	(5)	(6)
Bad & CDS Start	46.95**	100.7***	119.4***	95.01***	43.33**	100.1***
	(19.07)	(21.66)	(11.51)	(24.80)	(19.03)	(23.25)
No Bad & No CDS Start	-123.5***	-122.9***	-35.22***	-36.61***	-85.50***	-74.75***
	(9.683)	(12.00)	(8.414)	(13.06)	(10.26)	(12.24)
No Bad & CDS Start	-167.6***	-116.4***	-49.41***	-39.67*	-137.6***	-72.23***
	(13.82)	(20.02)	(10.49)	(22.45)	(13.82)	(21.40)
CDS Company	-4.209	-5.29			2.520	-9.70
	(6.466)	(17.03)			(7.115)	(18.97)
Constant	226.9***	229.9***	21.47	-121.4	-70.91	-29.18
	(38.58)	(51.70)	(75.07)	(97.21)	(46.08)	(65.62)
Firm Fixed Effect	No	No	Yes	Yes	No	No
Industry Fixed Effect	No	No	No	No	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
R Square	0.621	0.624	0.860	0.883	0.692	0.702
Observation	5,198	3,693	5,198	3,693	5,198	3,693

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. These regressions include all controls considered in section 3.4.1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Following Ashcraft and Santos (2009) and Amiram et al. (2017), we use the number of CDS quotes as the proxy for liquidity. If a CDS quotes number in the bond issue quarter is larger (smaller) than the average of that in our sample, the bond issue is assigned to the high (low) liquidity group. Table 3.9 shows that $Good_{i,t-1}$&CDS $Start_{i,t}$ is only significantly correlated with the yield spread for the high liquidity group. For the low liquidity group, it is either positive or insignificant negative. This result is consistent with our logic that the negative CDS effect is driven by the new hedging opportunity, which are highly dependent on the liquidity of the CDS market. Table 3.10 shows that all coefficients on $Bad_{i,t-1}$&CDS $Start_{i,t}$ are positive and significant no matter CDSs are liquid or not. It is because the positive CDS effect are derived from the concern of reduced bank monitoring and empty creditor problem which are both not relevant with the liquidity of the CDS market.

3.4.6 Does Financial Crisis matter?

The financial crisis in 2007 has been a tremendous shock to the world's economy. For the US CDS market, the nominal principle dropped dramatically from $58.24 trillion in 2007 (the peak) to $12.29 trillion by the end of 2015 (www.bis.org). With such a big fall, we cannot neglect the potential influence of the financial crisis on this research. Investors may view CDSs differently before and after the financial crisis, so we split our sample into two groups that before financial crisis and after financial crisis. Equations 3.17 and 3.18 are re-estimated using different subsamples and we display results in tables 3.11 and 3.12.

Table 3.11 The negative CDS impact on the yield spread before and after the financial crisis (2007)

Dependent variable:	Negative CDS Effect					
The Yield Spread	Before 2007	After 2006	Before 2007	After 2006	Before 2007	After 2006
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	-52.30***	99.21***	-28.44***	27.50	-47.99***	68.59**
	(10.36)	(29.10)	(8.537)	(21.87)	(9.931)	(31.17)
No Good & No CDS Start	9.181	70.51***	10.66	3.292	4.866	48.35***
	(6.627)	(17.00)	(7.372)	(19.73)	(7.824)	(17.81)
No Good & CDS Start	11.62	133.2***	32.58***	43.62**	6.620	73.29**
	(12.56)	(29.35)	(9.569)	(22.08)	(12.58)	(32.26)
CDS Company	-10.60*	-11.68			-4.574	-57.50*
	(6.335)	(16.87)			(6.889)	(29.82)
Constant	-11.15	-232.3**	-8.883	44.37	-219.7***	-56.62*
	(33.51)	(105.9)	(71.44)	(103.9)	(44.01)	(128.9)
Firm Fixed Effect	No	No	Yes	Yes	No	No
Industry Fixed Effect	No	No	No	No	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
R Square	0.527	0.635	0.825	0.921	0.642	0.779
Observation	4,233	2,125	4,233	2,125	4,233	2,125

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. These regressions include all controls considered in section 3.4.1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.12 The positive CDS impact on the yield spread before and after the financial crisis (2007)

Dependent variable:	Positive CDS Effect					
The Yield Spread	Before 2007	After 2006	Before 2007	After 2006	Before 2007	After 2006
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	36.35**	94.53***	61.52***	100.5***	34.24**	44.83**
	(15.81)	(31.09)	(10.09)	(22.52)	(15.84)	(20.36)
No Good & No CDS Start	-97.68***	-202.9***	-17.41**	-31.49	-67.91***	-150.0***
	(9.724)	(20.13)	(8.769)	(21.25)	(10.64)	(22.96)
No Good & CDS Start	-122.3***	-114.1***	-27.23***	-24.96**	-90.68***	-101.5***
	(13.50)	(31.05)	(9.972)	(23.23)	(13.31)	(35.77)
CDS Company	-9.958*	-7.82			-4.753	-62.57**
	(6.046)	(27.64)			(6.490)	(29.46)
Constant	165.1***	257.7**	24.83	136.2	-126.2***	366.2***
	(35.21)	(101.0)	(72.07)	(106.3)	(44.52)	(123.1)
Firm Fixed Effect	No	No	Yes	Yes	No	No
Industry Fixed Effect	No	No	No	No	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
R Square	0.562	0.697	0.826	0.923	0.656	0.797
Observation	4,233	2,125	4,233	2,125	4,233	2,125

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. These regressions include all controls considered in section 3.4.1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 3.11 shows that coefficients on $Good_{i,t-1}$&CDS $Start_{i,t}$ are negative and significant in column (1), (3) and (5) but positive in column (2), (4), (6). This suggests that before the financial crisis, when CDS reference firms issue bonds during their good credit periods, they can enjoy reduced yield spreads. However, it is changed after the financial crisis. They have to pay high prices to get financing even when they look good. It means that the negative CDS effect is overwhelmed by the positive CDS effect in all situations. Table 3.12 shows that all coefficients on $Bad_{i,t-1}$&CDS $Start_{i,t}$ are positive and statistically significant at 5% or 1% confidence level. This is in accordance with our expectation that CDS reference firms are penalized during their bad credit periods due to reduced bank monitoring and empty creditor problem. Through comparing, we can easily find that the penalty during firms' bad credit periods are aggravated after the financial crisis. In general, our analysis implies that investors' attitudes towards CDSs turn to negative after the financial crisis. It may be due to the reduce of risk preference of the whole financial market.

3.5 Conclusion

We report CDS effects, both negative and positive, on bond yield spreads. We underpin our investigation with a theoretical model, establishing the direction for our empirical work. Earlier literature provides support for either increased or decreased spreads following the introduction of named-firm CDSs into the market. We show how each of these can predominate, depending upon credit conditions for a firm, and present empirical evidence for our prediction. To our knowledge, this is the first such observation of negative and positive CDS effects.

This chapter uncovers an impact of the CDS market on the bond issue market and contributes to a better understanding of lenders' behaviors during different credit periods of the issuers. Our findings suggest that if issuers are during good credit periods, lenders view CDS trading as candy because a new hedging opportunity is created. However, if issuers are during bad credit periods, lenders view CDS trading as a shock due to the empty creditor problem and reduced bank monitoring.

Chapter 4

The impacts of credit default swaps on investment and the investment-cash flow sensitivity

4.1 Introduction

During the past decade the impact of credit derivatives has been controversial, with credit default swaps (CDSs) attracting most attention because they account for a large portion of the total credit derivatives market. CDSs can help creditors lay off their risks while maintaining voting rights, potentially changing the relationship between lenders and borrowers. When a firm is in financial distress and fails to pay his debts, creditors who had buy CDSs and may have no loss if default happening still hold the voting right in the firm's debt renegotiation. However, their interests may be different from other creditors who have not buy any CDS. In this chapter, we investigate whether and how the CDS market affects a firm's investment and its sensitivity of investment to cash flow.

Several channels may impact corporate investment, both favorably and unfavorably. On the favorable side, the CDS market provides new information and contributes to a more perfect capital market. According to Longstaff, Mithal, and Neis (2005), prices of CDSs offer investors a near-perfect instrument to measure firms' credit risks. Moreover, Hull, Predescu, and White (2004) argue that the CDS market can predict credit rating events. Acharya and Johnson (2007) present evidence on the information flow from the CDS market to the stock market. All these empirical findings indicate that the CDS market can relieve information asymmetries which leads to lower finance costs and thus stronger investment approaches. Also, CDSs can reduce the likelihood of strategic default. Bolton and Oechmke (2011) construct a credit limited commitment model to study the impacts of CDS on debt outcomes. Their model shows that the emergence of the CDS market strengthens investors' bargaining power and reduces the incentive of borrowers to default strategically. Credit default swaps work as a commitment device and to some extent relieve the distrust between borrowers and creditors. They promote corporate investment from easier external financing. Lastly, CDSs break the separation between those willing to hold risk and those with capital. Saretto and Tookes (2013) claim that CDSs help to increase banks' incentive to lend by reducing conflicts on the credit supply side.

On the adverse side, impact comes in three ways. Parlour and Winton (2013) suggest that banks will not monitor borrowers if they can lay off their risks through buying credit default swaps. Compared with individual lenders, banks have scale and information advantages in monitoring. Consequently, debtors and other lenders become free riders in this financing mechanism. If banks do not monitor borrowers because of CDSs, signals and safeguards for these free riders are lost, reducing their willingness to lend and decreasing credit supply. Subsequently, CDSs increase the credit risk of reference firms. Subrahmanyam et al. (2014) give detailed evidence that firms are more likely to be downgraded and go into bankruptcy after their debts are referenced by CDSs. The increase of the credit risk raises the financing costs of reference firms and thus depresses their investment impulses. Last but not least, CDSs create exacting creditors and push reference firms into raising their cash holdings. The model of Bolton and

Oechmke (2011) shows that CDS-protected lenders are tougher in debt renegotiation, particularly when they hold large CDS positions. This puts pressure on the firms and makes them adjust investment strategies. Subrahmanyam et al. (2017) claim that reference firms have to increase cash reserve for future use after predicting this threat from tough creditors.

Why would CDSs influence firms' investment-cash flow sensitivity? Exactly because credit default swaps impact the firms' whole capital status. On the one hand, CDSs affect a firm's capacity for getting external funds. On the other hand, CDSs change the firm's demand for cash reserves. According to Saretto and Tookes (2013), firms would have higher leverage ratios after CDS trading. Moreover, Subrahmanyam et al. (2017) claim that firms' cash holdings increase as well and it is probably maintained by using higher leverage. If the increase in leverage can overwhelm the increased need of cash holding, we can expect that the firm's financial constraints are loosened after the onset of CDS trading. However, if the additional leverage can just compensate or even not compensate the growing cash reserve, we predict CDSs have no or adverse effect on the severity of a firm's financial constraints. Fazzari et al. (1988) claim that a firm depends more on its cash flow to investment when it faces severer financial constraints. Therefore, after CDS trading, intuitively a firm's investment-cash flow sensitivity will go down for the former scenario but go up for the latter.

Findings from Longstaff, Mithal, and Neis (2005), Hull, Predescu, and White (2004) and Acharya and Johnson (2007) suggest that the initiation of the CDS market brings clear price signal to investors and this is helpful to reduce the information asymmetry in an imperfect market. Moreover, Bolton and Oechmke (2011) claim that CDSs can work as a commitment device relieving the distrust between borrowers and creditors. These changes reduce conflicts on credit supply side and make creditors more likely to lend money. With such an easy financing environment, firms may have high enthusiasm to borrow funds and implement investments. Based on this logic, we proceed to the following hypothesis:

Hypothesis 1a: CDS reference firms increase their investments after the initiation of the CDS market.

On the other hand, the emergence of the CDS market reduce the incentive of bank monitoring (Parlour and Winton, 2013). Without that, some other creditors lose the opportunity to be free riders depressing their willingness to lend money. In addition, CDSs increase the credit risk of reference firms (Subrahmanyam et al., 2014) keeping conservative lenders away. These two variations may lead to higher financing costs and thus restrain corporate investments. Furthermore, CDS reference firms have to increase cash holdings to defend exacting creditors and may have less capital to invest (Subrahmanyam et al., 2017). From this point of view, we have the following alternative hypothesis:

Hypothesis 1b: CDS reference firms reduce their investments after the initiation of the CDS market.

CDSs increase firms' leverage (Saretto and Tookes (2013) and cash serves (Subrahmanyam et al., 2017) simultaneously. The dominance of these two effects give us two alternative hypotheses as follows:

Hypothesis 2a: CDS reference firms are more dependent on their cash flows to invest after the beginning of CDS trading.

Hypothesis 2b: CDS reference firms are less dependent on their cash flows to invest after the initiation of the CDS market.

We construct a CRSP-Compustat and Markit merged data set to investigate the impact of CDSs on corporate investment and the investment-cash flow sensitivity. Considering different behaviors of manufacturing firms in investing, we present outcomes for both the broad sample, which contains all sectors, and for the manufacturing sample. Our results show that reference firms reduce their investments, on average, after introducing credit default swaps and their investment-cash flow sensitivities increase simultaneously. Results for the broad sample and manufacturing sample are generally robust. We also construct a variety of subsamples for studying whether the CDS effects vary across groups. We find that, following the inception of CDS trading, firms with high liquidity or integrity enhance their investments and rely less on cash flow to invest. In contrast, firms with low liquidity or integrity face severer financial constraints and have to cut down their investments.

To our knowledge, the impacts of CDS on investment and the investment-cash flow sensitivity have never been analyzed before though some papers state the importance of this topic (Augustin et al., 2016 and Subrahmanyam et al., 2017). Our study exactly fills this gap and presents a better understanding. Moreover, our research sheds light on the consequence of financial innovations on an imperfect market. Many scholars believe that credit derivatives can relieve frictions in the economy and bring us a more efficient market. Through investigating the relationship between investment and credit default swaps, we can concretely test whether firms in the economy do indeed profit from financial innovations. Furthermore, we are able directly to test the model proposed by Bolton and Oechmke in 2011.

The rest of the chapter is organized as follows. Section 4.2 describes data and the empirical specification. Section 4.3 presents empirical results and analyses of CDS effects on investment and investment-cash flow sensitivity. Section 4.4 gives the conclusion.

4.2 Methodology and Data

4.2.1 Empirical specification

The literature suggests that, after the inception of CDS trading, reference firms have increased leverage. However, whether the firms exploit this financial advantage to implement more investment remains ambiguous. There is also evidence that the firms prefer to hold more cash once their debts are referenced by credit default swaps. As a result, it is possible either that the firms, after CDS trading, spend more to invest responding to the growth of leverage or that the firms reduce capital expenditure in order to reserve cash. To investigate which effect dominates the other, we use the following specification:

$$I_{it}/TA_{it-1} = c + \beta_1 I_{it-1}/TA_{it-2} + \beta_2 CF_{it}/TA_{it-1} + \beta_3 Q_{it-1} + \beta_4 CDS\ Start_{it} + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (4.1)$$

I_{it}/TA_{it-1} is the dependent variable defined as the fixed investment, I_{it}, of the firm divided by its total assets in last period, TA_{it-1}. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. It controls the autocorrelation of investment decision. Due to different industries and development stages, the absolute values of firms' investments cannot be compared. Therefore, instead of using absolute value of investment, we take a relative one. Dividing firms' investments by their total assets in the last period makes every firm comparable. For the same reason, we deflate firms' cash flows by their total assets in the last period. CF_{it}/TA_{it-1} is the ratio of the firm's cash flow, CF_{it}, to its last period total assets, TA_{it-1}.

We use Tobin's Q to measure firms' investment opportunities. In the Q theory, marginal Q is very important and even sufficient factor to explain firms' investments. Following Allayannis and Mozumdar (2004), Q_{it-1} is calculated by equity market value to book value of asset in the last period. Our interest is the dummy variable CDS $Start_{it}$, which equals 0 for investments occurring before the onset of CDS trading, 1 otherwise. The coefficient β_1 captures the dynamic effect between investment in this year and last year. Considering the continuity of investment, this coefficient is expected to be positive. The coefficient β_2 measures the sensitivity of investment to cash flow. In most cases, cash flow as the main source of internal financing is positivity related to a firm's investment. Estimated on average level, β_2 should be bigger than 0. The coefficient β_3 shows the relationship between investment and investment opportunities. Firms with more opportunities normally invest more than firms with less, so we expect β_3 to be positive. The main interest is the coefficient β_4 that uncovers the impact of CDS on investment. Since firms increase both leverage and cash holding after CDS trading, the symbol of β_4 may depends. On average, we anticipate that the CDS effect on investment is negative because firms with high risk find it hard to increase leverage even after CDS trading but they have to reserve cash to guard against exacting lenders.

As the sensitivity of investment to cash flow can be used as an indicator of financial constraints, the impact of CDS on the sensitivity can potentially help to understand whether credit default swaps change the situation of capital shortage. If the increase of leverage is larger than that of cash reserve needed, financial constraints are loosened for reference firms and they can turn to these funds to invest. However, if the increment of external financing is insufficient to compensate the raised demand of cash holding, the economic intuition is that firms' investments depend more heavily on cash flows compared with the situation before the emergence of the CDS market. To study how CDSs affect the sensitivity of investment to cash flow, the model is specified as follows:

$$I_{it}/TA_{it-1} = c + \beta_1 I_{it-1}/TA_{it-2} + \beta_2 CF_{it}/TA_{it-1} + \beta_3 Q_{it-1} + \beta_4 CDS\ Start_{it} + \beta_5 (CF_{it}/TA_{it-1} \times CDS\ Start_{it}) + \alpha_i + \alpha_t + \varepsilon_{it}. \tag{4.2}$$

All variables are as described previously, besides the interaction of CF_{it}/TA_{it-1} and CDS $Start_{it}$ introduced to observe a change of the investment-cash flow sensitivity after CDS trading. We expect firms with low credit risks can leave a part of the increased financing after adding cash holding while the increment of cash reserving is higher than that of leverage for firms with high credit risks. Thus, altogether, funds are in shortage and firms rely more on cash flow to invest, contributing to a positive β_5.

The specifications above are estimated by the first difference generalized method of moments (GMM) approach proposed by Arellano and Bond in 1991 to eliminate endogeneity. In our estimations, two or more lags of each regressor are included as instrument variables and the instruments matrix also contains the time dummies. According to Roodman (2006), the instrument set, which starts from the lag n to the deeper one is only valid when the differenced residuals are not serially correlated in order n. Thus, to effectively use GMM, we need to ensure that differenced residuals are not nth-order serially correlated. We use an M(n) test to investigate this and, if there is no nth-order correlation, we would find the statistic is asymptotically standard normal. Moreover, a correct GMM model also requires that the instruments in the set are not correlated with the error term. We employ a Hansen test to avoid this concern. If the test cannot reject the null, the instruments used are valid and the statistic distributes like a $\chi 2$ function.

4.2.2 Sample separation standard

The literature shows that the potential effects of CDSs vary across different firm groups (Subrahmanyam et al., 2017; Ashcraft and Santos, 2009). In our research, two main sources leading to changes in investment for reference firms are increases of corporate leverage and cash reserve. After CDS trading, reference firms find it easier to obtain external financing but they also have an incentive to retain more cash for resisting threats from exacting creditors. However, these two effects are not same for every reference firm. When CDSs reduce the frictions on the credit supply side, most of this easing targets firms with low credit risks and so firms with high credit risks may not benefit much. Correspondingly, healthy firms are relatively not affected by exacting creditors and have less pressure of raising cash compared to the counterpart. As a result, we have sufficient reasons to anticipate that the CDS effects on investment and the investment-cash flow sensitivity are different across groups.

Since the CDS effects may be related with the credit risk of reference firms, we split the sample by a variety of measures for firm quality. Two kinds of credit proxies are employed in our analyses. One is liquidity indicators including cash flow level and coverage ratio. High liquidity firms are popular among investors and can benefit more from credit easing due to the initiation of the CDS market. On the other hand, they may be not affected by exacting creditors as much as low liquidity firms. Firms with strong cash flows have sufficient funds to cover their maturing debts and face small probability of debt restructuring which would bring exacting creditors after CDS trading. Similarly, firms with high coverage ratios have sufficient income to pay interest expenses and their intentions to increase cash reserve for defending against exacting creditors are low. We display a statistics comparison of average leverage before and after CDS trading for high and low liquidity firms in table A 8. It shows that the increasing ratio of leverage for high liquidity firms are much greater than that for low liquidity firms. Simultaneously, high liquidity firms have smaller increasing ratio of cash holdings compared to low liquidity firms. So, high cash flow/coverage ratio firms are more likely to invest more and depend less on cash to invest after CDS trading. The sample is divided into three groups: liquidity sufficient firms, liquidity moderate firms and liquidity constraint firms. Liquidity sufficient, moderate and constrained firms represent firms' average coverage ratios or cash flows are below 25th, above 25th but below 75th and above 75th percentile of the liquidity distribution for firms in the same industry.

The other is integrity indicators that contain firm age and credit rating. Firm age is a valuable credit proxy, especially considering the existence of information asymmetry. Young firms normally have few debit records and financial data, making them looked high-risk to outside investors. Evidence from the bond market shows that an issuer's age is negatively related to the cost of debt financing. It is probable that older firms can obtain more external financing than younger firms under increased credit supply due to the beginning of the CDS market. Rating agencies are gatekeepers of the economy and are believed to have firms' private information. There is no doubt that firms with high rating grades are popular among lenders and so we expect, once CDS trading has begun, high rating firms can gain more credit increase than firms with low ratings. Consequently, we argue that old firms and firms with high ratings can implement more investments and display lower investment-cash flow sensitivity after the inception of CDS trading. We construct integrity reliable, ordinary and suspicious subsamples in which firms' ages or average ratings are below 25th, above 25th but below 75th and above 75th percentile of the integrity distribution for firms in the same industry.

A specified construction is that our liquidity and integrity indicators can also be viewed as proxies for internal and external financial constraints (Guariglia, 2008). That gives the opportunity to observe which sort of firms benefit more, constrained or unconstrained, from the rise of the CDS market.

4.2.3 Data

Our research is based on two main databases: CRSP-Compustat and Markit. To start with, we need to know which firms are referenced by credit default swaps and the timing of inception of CDS trading. We obtain daily CDS quotes from the Markit CDS database. Markit is a widely used source for dealer quotes of credit default swaps. We select all firms that have CDS quotes and use the first CDS appearance date of a firm, denominated in US dollars and having five years maturity, as the beginning time of CDS trading for that firm. The sample period is from January 2001 to December 2014. January 2001 is the start of the Markit CDS database. Then we merge selected firms with fundamental information from the CRSP-Compustat yearly database. CRSP-Compustat contains financial, market, and statistical data of most listed North America firms and provides our research several firm-specific fundamentals. Since the financial sector is seen as different from other economic sectors, we take only non-financial firms into consideration. All firms are required to have no missing values for all interested variables. To exclude the impact of outliers, we windsorize all interested variables at the 5th and 95th percentiles. In the end, we obtain 741 CDS reference firms and 11683 firm-year data.

Table 4.1 summarizes the statistics of the variables included in our analyses. The literature shows that manufacturing sector investment can differ from others, so the broad sample including all sectors and the manufacturing sample should be investigated simultaneously. Following this routine, we report both the broad sample and the manufacturing sample. Panel A shows means and standard deviations of variables before and after CDS trading and their differences. Panel B reports the statistics for subsamples having diverse liquidity levels. Correspondingly, panel C describes the statistics for subsamples grouped according to the extent of firms' integrities.

Table 4.1 Summary statistics.

Panel A: Before vs after CDS trading						
Variables	Broad Sample			Manufacturing Sample		
	Before	After	Difference	Before	After	Difference
Total Assets	9370.4	20556.02	11185.62***	8292.87	17398.97	9106.1***
	(25226.6)	(49038.5)		（21912.7）	（34887.4）	
I_{it}/TA_{it-1}	0.0817	0.0564	-0.0253***	0.0637	0.0405	-0.0232***
	(0.0908)	(0.0555)		（0.0473）	（0.0297）	
CF_{it}/TA_{it-1}	0.1118	0.1036	-0.0008***	0.1124	0.1065	-0.0059***
	(0.0861)	(0.0678)		(0.0799)	(0.0724)	
Q_{it-1}	3.2272	3.0722	-0.155**	3.7026	3.5493	-0.1534
	(4.1719)	(4.2528)		(4.4536)	(4.7025)	
Number of observations	5246	6437	11683	2317	3013	5430

Panel B: Subsamples depend on firm liquidity						
	Using cash flow as the proxy			Using coverage ratio as the proxy		
Broad Sample						
Variables	Liquidity sufficient	Liquidity moderate	Liquidity constrained	Liquidity sufficient	Liquidity moderate	Liquidity constrained
Total Assets	24425.91	12684.78	11943.57	19409.18	13326.55	9702.638
	（65750.41）	(25149.3)	(27777.13)	（42208.79）	（38957.94）	（21561.35）
I_{it}/TA_{it-1}	0.0908	0.0646	0.0492	0.0693	0.0664	0.0649
	（0.0925）	(0.0669)	(0.0605)	（0 .0688）	（0.0702）	（0.0933）
CF_{it}/TA_{it-1}	0.1679	0.1006	0.0549	0.1468	0.1087	0.0733
	（0.0794）	(0.06)	(0.0591)	（0.0873）	（0.0684）	（0.0621）
Q_{it-1}	4.7626	2.763	2.1794	4.1213	3.1969	2.3215
	（5.4493）	(3.296)	(3.9564)	（4.2085）	（4.2582）	（4.644）
Number of observations	3006	5960	2717	2463	4760	2176
Manufacturing Sample						
Total Assets	22293.83	8923.78	13172.76	19928.28	9802.37	11668.98
	(41767.22)	(13736.18)	(37707.74)	(41133.87)	(15941.9)	(27431.35)
I_{it}/TA_{it-1}	0.0594	0 .0509	0.0415	0 .0527	0.0513	0.0478
	(0.0449)	(0.0392)	(0.0346)	(0.0462)	(0.0366)	(0.0389)

CF_{it}/TA_{it-1}	0.1673	0 .1045	0.0568	0.1487	0 .1074	0.0735
	(0. 0687)	(0.0567)	(0. 0607)	(0.0817)	(0.0565)	(0.0553)
Q_{it-1}	5.8652	3.105	2.3048	4.7356	3.4128	2.6237
	(5.7207)	(3.4344)	(4.5598)	(4.7335)	(4.1528)	(4.7076)
Number of observations	1384	2750	1296	1314	2606	1206

Panel C: Subsamples depend on firm integrity

	Using age as the proxy			Using credit rating as the proxy		
Broad Sample						
Variables	Integrity reliable	Integrity ordinary	Integrity suspicious	Integrity reliable	Integrity ordinary	Integrity suspicious
Total Assets	27090.4	11940.68	6917.76	26795.71	14909.9	5356.1
	(60360.77)	(30141.62)	(9871.11)	(40997.35)	(47836.22)	(7593.62)
I_{it}/TA_{it-1}	0.0591	0.0712	0.0728	0.066	0 .0648	0 .0757
	(0 .0472)	(0.0811)	(0.0890)	(0.0543)	(0.0647)	(0.1044)
CF_{it}/TA_{it-1}	0 .0999	0.1146	0.1019	0.1299	0 .1073	0.0842
	(0.0628)	(0 .0803)	(0.0845)	(0.0666)	(0.0772)	(0 .0782)
Q_{it-1}	3.3608	3.0971	2.9283	4.1469	3.1132	2.1786
	(4.2278)	(3.8106)	(4.9563)	(3.9914)	(3.7942)	(4.9595)
Number of observations	3620	5501	2562	2935	5859	2889
Manufacturing Sample						
Total Assets	27469.45	7117.44	5943.05	25968.47	11559.01	3922.06
	(47408.42)	(13366.55)	(8750.75)	(40358.69)	(29245.61)	(4199.67)
I_{it}/TA_{it-1}	0 .0497	0.0523	0 .0495	0.051	0 .0488	0.0547
	(0.0307)	(0.045)	(0 .0419)	(0.0309)	(0 .0361)	(0.0541)
CF_{it}/TA_{it-1}	0 .1122	0 .1143	0 .0949	0 .1416	0 .1061	0.0818
	(0.0617)	(0.0752)	(0.0784)	(0.0599)	(0.0691)	(0.0777)
Q_{it-1}	4.4371	3.3905	2.9313	5.2642	3.4104	2.336
	(5.3403)	(3.952)	(4.4703)	(4.9372)	(4.0406)	(4.781)
Number of observations	1735	2425	1270	1384	2705	1341

Panel A displays descriptive statistics for the broad sample and manufacturing sample. I_{it} is the firm's fixed investment this term. TA_{it-1} is the firm's total assets last term. I_{it}/TA_{it-1} is the relative value of investment. CF_{it} is the firm's cash flow this term. CF_{it}/TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. Panel B reports statistics for two samples depending on firm liquidity. We use cash flow and coverage ratio as two proxies. Liquidity sufficient, moderate and constrained firms represent firms' average coverage ratios or cash flows are below 25th, above 25th but below 75th and above 75th percentile of the liquidity distribution for firms in the same industry. Panel C presents statistics for two samples depending on firm integrity. We use firm age and credit rating as the proxies. Integrity reliable, ordinary and suspicious firms represent firms' average ages or credit ratings are below 25th, above 25th but below 75th and above 75th percentile of the integrity distribution for firms in the same industry. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

The statistics comparison showed in panel A can give us some insight into what happens after introducing credit default swaps. We find that firms' total assets, for both samples, increase dramatically after the inception of CDS trading. This is not surprising considering the 'after data' are always later than the 'before data' and firms' total assets should inflate with years. Moreover, banks prefer to sell CDS contracts that reference large firms (Subrahmanyam et al., 2014). Investment scaled by total assets last term (I_{it} /TA_{it-1}) decreases 30.97% for the broad sample and 19.69% for the manufacturing sample after CDS trading. This implies that CDS reference firms may have to reduce investment for increasing cash reserve to resist exacting debtors. Cash flow divided by total assets last year (CF_{it}/TA_{it-1}) decreases slightly after the onset of CDS trading. Although statistically significant, the difference is very small economically. This suggests that, the operation and performance of firms do not change much. The decrease of Tobin's Q is quite obscure, especially for the manufacturing sample.

We divide the broad and manufacturing samples into three subsets based on firm liquidity measured by two proxies, cash flow and coverage ratio. Panel B shows that, for the broad sample, total assets, investment scaled by total assets last year (I_{it} /TA_{it-1}) and Tobin's Q increase monotonically with the increase of cash flow scaled by total assets last year (CF_{it}/TA_{it-1}). Using coverage ratio as the liquidity proxy, we find similar results. For the manufacturing sample, the subset of liquidity moderate has the lowest total assets while the subset of liquidity sufficient has the highest no matter which indicator is used. However, other variables that I_{it} /TA_{it-1}, CF_{it}/TA_{it-1} and Tobin's Q are on the same growth trend of coverage ratio. Despite having the largest total assets that scales investment, the liquidity sufficient group still has the highest ratio of investment to total assets (I_{it} /TA_{it-1}). This indicates that liquidity sufficient firms invest much more than firms in the other groups.

We also split the samples depending on firm integrity gauged by age and credit rating. For the broad sample, in Panel C, total assets and Tobin's Q increase monotonically with the raising of firm age or credit rating. Nevertheless, the group we name 'integrity suspicious' has the largest investment to total assets ratio (I_{it}/TA_{it-1}) when use both proxies. This result differs greatly from findings in Panel B and the probable reason is that firm integrity is highly correlated with firm total assets and the smallest total assets leads to the largest I_{it}/TA_{it-1}. The ratio of cash flow to total assets (CF_{it}/TA_{it-1}) is highest for integrity ordinary firms using firm age as the proxy but highest for integrity reliable firms using credit rating. For the manufacturing sample, integrity ordinary firms have the largest I_{it}/TA_{it-1} and CF_{it}/TA_{it-1} when using firm age as the proxy but integrity reliable firms have the largest when using credit rating. Total assets and Tobin's Q perform similarly with those in the broad sample.

4.3 Empirical Results

Our interest is to investigate the CDS effect on a firm's investment and whether the sensitivity of investment to cash flow changes after introducing credit default swaps. In this section, we first present empirical findings for the broad and the manufacturing samples. Afterwards, considering the CDS effects may vary across different groups, we present our findings for subsamples based on several proxies for a firm's liquidity and integrity.

4.3.1 The CDS impacts on investment and the investment-cash flow sensitivity

Table 4.2 The average CDS effects for broad and manufacturing sample

Dependent variable: I_{it}/TA_{it-1}	Broad Sample		Manufacturing Sample	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.344***	-0.0398	0.353***	0.255*
	(0.093)	(0.0766)	(0.0507)	(0.131)
Q_{it-1}	0.000731	-0.00101	-0.0000578	0.0000481
	(0.000664)	(0.00092)	(0.00024)	(0.000459)
CF_{it}/TA_{it-1}	0.310***	0.238***	0.197***	0.0594
	(0.0936)	(0.0889)	(0.0329)	(0.117)
CDS $Start_{it}$	-0.00432**	-0.0405**	0.0029	-0.0242**
	(0.0022)	(0.0177)	(0.00213)	(0.00989)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		0.345**		0.256**
		(0.167)		(0.102)
Observations	11,683	11,683	5,430	5,430
M1(p)	0.000	0.045	0.000	0.007
M2(p)	0.619	0.107	0.435	0.455
Hansen(p)	0.178	0.387	0.435	0.514

Table 4.2 shows results of equation 1 and 2 for the broad sample and the manufacturing industry. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Columns (1) and (2), in table 4.2, show the regression results of equations (4.1) and (4.2) for the broad sample and corresponding columns (3) and (4) display that for the manufacturing sample. We can readily see that the coefficient estimate for CDS $Start_{it}$ in column (1) is negative and statistically significant, which suggests that the investment of reference firms decreases after CDS trading when we consider all industries. Column (2) shows that the coefficient on interaction of CDS $Start_{it}$ and CF_{it}/TA_{it-1} is positive and significant at 5% confidence level, indicating that, after the onset of CDS trading, the firms are more dependent on their cash flows for investments. Moreover, the decreased investment and the raised investment-cash flow sensitivity could be indirect evidence that, on average, the easing of credit supply is overwhelmed by the need for reserving cash attributed to the introduce of credit default swaps. For the manufacturing sample, the effect of CDS on a firm's investment is not significant. However, we also observe the positive and significant coefficient on the interaction.

Coefficients of other regressors are mostly consistent with findings from the literature. As predicted, the investment this term positively and significantly correlated with the investment last term and there is definitely an intertemporal effect on financial decisions. Columns (1), (2) and (3) show that the coefficients on CF_{it}/TA_{it-1} are positive and significant at 1% confidence level, which signifies that cash flow is a very important source for a firm's investment. Coefficients on Q_{it-1} are insignificant and the probable reason could be that the effect of Tobin's Q is explained by lags of other regressors used as instrument variables in our regressions.

4.3.2 The CDS impacts with different liquidities

Table 4.3 Using cash flow as the liquidity proxy

Panel A: Broad Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Liquidity sufficient		Liquidity moderate		Liquidity constrained	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.253**	0.207*	0.245***	0.206**	0.133**	0.143**
	(0.122)	(0.116)	(0.082)	(0.096)	(0.0551)	(0.0689)
Q_{it-1}	0.000234	0.000436	0.001144	-0.000189	-0.000484	-0.000683
	(0.000472)	(0.000619)	(0.000738)	(0.00104)	(0.000714)	(0.000851)
CF_{it}/TA_{it-1}	0.410***	0.444***	0.411***	0.222***	0.147***	0.0132
	(0.115)	(0.132)	(0.109)	(0.075)	(0.056)	(0.074)
CDS $Start_{it}$	-0.00586	-0.0167	-0.00148	-0.0021	-0.00980**	-0.0195***
	(0.00439)	(0.0217)	(0.00274)	(0.0085)	(0.00467)	(0.00605)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		0.0679		0.129		0.186**
		(0.135)		(0.081)		(0.0892)
Observations	3006	3006	5960	5960	2717	2717
M1(p)	0.001	0.001	0.029	0.017	0.033	0.021
M2(p)	0.245	0.187	0.175	0.128	0.167	0.184
Hansen(p)	0.933	0.264	0.198	0.186	1	1
Panel B: Manufacturing Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Liquidity sufficient		Liquidity moderate		Liquidity constrained	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.394***	0.351***	0.294***	0.253***	0.101	0.177**
	(0.0491)	(0.0458)	(0.0623)	(0.0745)	(0.0982)	(0.0851)
Q_{it-1}	-0.000174	-0.000203	0.000758	0.000726	-0.000364	-0.000468
	(0.00024)	(0.000262)	(0.000583)	(0.000698)	(0.000507)	(0.000416)
CF_{it}/TA_{it-1}	0.236***	0.328***	0.141***	0.244***	0.0443	0.0154
	(0.0478)	(0.0688)	(0.0313)	(0.0598)	(0.0646)	(0.0692)
CDS $Start_{it}$	0.00572	0.0359***	0.00485	0.0235***	-0.00463*	-0.00933**
	(0.00393)	(0.0132)	-0.00386	(0.00878)	(0.0026)	(0.00429)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.194***		-0.194**		0.107
		(0.0714)		(0.0783)		(0.0703)
Observations	1384	1384	2750	2750	1296	1296
M1(p)	0.000	0.000	0.000	0.001	0.023	0.004
M2(p)	0.326	0.306	0.487	0.356	0.295	0.37
Hansen(p)	1	1	1	1	1	1

Table 4.3 shows results using cash flow as the proxy. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. Observations are the numbers of observations. Number of ID is the number of firms. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. The criterion for sample splitting has been shown in Table 1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

According to Subrahmanyam et al. (2017), liquidity constrained firms are more likely to store cash for resisting exacting debtors. Moreover, Ashcraft and Santos (2009) show that safe firms benefit more from external financing than risky firms. Therefore, it is probable that firms with different liquidities behave divergently when they make investment decisions.

Table 4.3 lists empirical results for liquidity sufficient, liquidity moderate and liquidity constrained subsamples based on firms' cash flow levels. Panel A shows that coefficients on CDS $Start_{it}$ in columns (1) and (3) are insignificant. However, that in column (5) is negative and significant at 5% confidence level. This comparison indicates that investments of firms with sufficient and moderate liquidities do not change much but investments of liquidity constrained firms decrease obviously after the inception of CDS trading. This could be explained by the finding from Subrahmanyam et al. (2017) that liquidity constrained firms hold more cash than their counterparts after the CDS market has started. Columns (2), (4) and (6) show regression results of equation (4.2) that investigates the CDS effect on the sensitivity of investment to cash flow. Coefficients on $CF_{it}/TA_{it-1}\times$CDS $Start_{it}$ in Columns (2) and (4) are insignificant but the coefficient in column (6) is positive and significant, suggesting that liquidity constrained firms depend more on cash to invest than they were before the emergence of the CDS market.

Panel B of table 3 shows results using the manufacturing sample. Similarly, we find that the coefficient on $Start_{it}$ is significant in the fifth column but not in the first or the third. In manufacturing industry, firms with constrained liquidities also experience reduced investments after credit default swaps reference their debts. Coefficients on

$CF_{it}/TA_{it-1} \times CDS\ Start_{it}$ in Columns (2) and (4) are negative and significant but the coefficient in column (6) is insignificant, signifying that liquidity unconstrained manufacturing firms, especially sufficient manufacturing firms, depend less on cash to invest after the onset of CDS trading but liquidity constrained manufacturing firms do not. This implies that liquidity constrained manufacturing firms may not enjoy the credit supply easing caused by the activation of the CDS market. Coefficients on $CF_{it}/TA_{it-1} \times CDS\ Start_{it}$ in columns (2) and (4) of panel B are negative. However, that in column (6) of panel A is positive. This heterogeneity is due to the different dominance of two CDS effects. Liquidity moderate and sufficient firms can benefit more from credit easing but have less need to increase cash reserves, so rely less on cash flows to invest. However, liquidity constrained firms cannot benefit as much but demand more cash reserves leading to higher dependence.

Table 4.4 Using coverage ratio as the liquidity proxy

Panel A: Broad Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Liquidity sufficient		Liquidity moderate		Liquidity constrained	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.365***	0.425***	0.167**	0.160**	0.0299	0.0652
	(0.0555)	(0.0507)	(0.0697)	(0.0701)	(0.0914)	(0.0688)
Q_{it-1}	0.000346	0.000403	0.000684*	0.000667*	0.00065	0.000136
	(0.000773)	(0.000638)	(0.000382)	(0.000366)	(0.000488)	(0.000453)
CF_{it}/TA_{it-1}	0.282***	0.285***	0.231***	0.175***	0.438***	0.516**
	(0.0618)	(0.0547)	(0.0511)	(0.0481)	(0.167)	(0.207)
CDS $Start_{it}$	0.00816**	0.0260***	-0.000969	-0.015	-0.0146**	-0.00902
	(0.00401)	(0.00974)	(0.0031)	(0.00996)	(0.00703)	(0.0214)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.123**		0.104		0.0284
		(0.0517)		(0.083)		(0.307)
Observations	2463	2463	4760	4760	2176	2176
M1(p)	0.000	0.000	0.003	0.003	0.018	0.039
M2(p)	0.16	0.185	0.168	0.165	0.27	0.353
Hansen(p)	0.985	1	0.992	1	1	1
Panel B: Manufacturing Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Liquidity sufficient		Liquidity moderate		Liquidity constrained	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.327***	0.326***	0.530***	0.448***	0.206***	0.302***
	(0.0533)	(0.0554)	(0.0441)	(0.0549)	(0.0675)	(0.102)
Q_{it-1}	0.000818	0.000488	0.000430**	6.47e-05	3.41e-05	0.000164
	(0.000517)	(0.000485)	(0.000214)	(0.000192)	(0.000383)	(0.000445)
CF_{it}/TA_{it-1}	0.189***	0.291***	0.0873***	0.149***	0.171***	-0.0015
	(0.0517)	(0.0540)	(0.0295)	(0.0539)	(0.0577)	(0.0775)
CDS $Start_{it}$	0.00867**	0.0356***	0.00126	0.00347	0.00511	-0.0164
	(0.00366)	(0.00842)	(0.00275)	(0.00789)	(0.00428)	(0.012)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.212***		-0.0217		0.275
		(0.0508)		(0.0705)		(0.222)
Observations	1,314	1,314	2,606	2,606	1,206	1,206
M1(p)	0.001	0.000	0.000	0.000	0.031	0.035
M2(p)	0.244	0.31	0.115	0.423	0.972	0.816
Hansen(p)	1	1	1	1	1	0.676

Table 4.4 shows results using coverage ratio as the proxy. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it}/TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. The criterion for sample splitting has been shown in Table 1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 4.4 reports results of the subsamples based on firms' coverage ratios that defined as the profit before tax and interest divided by interest payments. Coverage ratio is a widely used liquidity proxy measuring a firm's capacity to repay debt. Panel A of table 4.4 shows that the coefficient, in column (1), on CDS $Start_{it}$ for liquidity sufficient firms is positive and significant while that, in column (5) for liquidity constrained firms is negative and significant. This indicates that firms having strong repayment ability invest more after CDS trading but firms with limited liquidity reduce their investments after that. This conflict is due to the different CDS effects on liquidity sufficient and constrained firms in dimensions of credit supply easing and the need for storing cash. The coefficient on CDS $Start_{it}$ in column (3) is insignificant and can be attributed to the offset of raising both leverage and cash holding. The coefficient on $CF_{it}/TA_{it-1}\times$CDS $Start_{it}$ in Column (2) is negative and statistically significant at 1% confidence level signifying that only liquidity sufficient firms have a lower investment-cash flow sensitivity and loosed financial constraints after the introduction of CDS trading.

Results for the manufacturing sample are similar to findings from panel A. Liquidity sufficient firms implement more investment after the inception of CDS trading and depend less on cash flow to invest. However, we do not observe the negative and significant coefficient on CDS $Start_{it}$ in column (5) of panel B. In general, we find that, compared to other industries, manufacturing benefits more from the beginning of the CDS market and experiences a more relaxed financing environment.

4.3.3 The CDS impacts with different integrities

Table 4.5 Using firm age as the integrity proxy

Panel A: Broad Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Integrity reliable		Integrity ordinary		Integrity suspicious	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.353***	0.263***	0.303***	0.265***	0.266***	0.253***
	(0.0768)	(0.0948)	(0.0723)	(0.0822)	(0.0915)	(0.0911)
Q_{it-1}	0.000280	0.000193	0.000617	0.000528	-0.000435	-0.000667
	(0.000286)	(0.000240)	(0.000456)	(0.000483)	(0.000422)	(0.000431)
CF_{it}/TA_{it-1}	0.245***	0.273***	0.339***	0.342***	0.264***	0.243***
	(0.0488)	(0.0564)	(0.0650)	(0.0732)	(0.0702)	(0.0790)
CDS $Start_{it}$	-0.00239	0.00487	-0.00152	0.000602	-0.00826*	-0.0187*
	(0.00347)	(0.00478)	(0.00358)	(0.00842)	(0.00459)	(0.0111)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.0767*		-0.0233		0.0818
		(0.0433)		(0.0802)		(0.0978)
Observations	3,620	3,620	5,501	5,501	2,562	2,562
M1(p)	0.000	0.000	0.005	0.046	0.011	0.011
M2(p)	0.594	0.254	0.88	0.97	0.53	0.556
Hansen(p)	0.787	1	1	1	1	1
Panel B: Manufacturing Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Integrity reliable		Integrity ordinary		Integrity suspicious	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.466***	0.438***	0.487***	0.326***	0.221***	0.227***
	(0.0514)	(0.0654)	(0.0647)	(0.0564)	(0.0654)	(0.0626)
Q_{it-1}	0.000108	1.95e-05	-0.000289	-0.000713	-0.000215	-0.000253
	(0.000164)	(0.000182)	(0.000470)	(0.000563)	(0.000426)	(0.000411)
CF_{it}/TA_{it-1}	0.121***	0.230***	0.167***	0.241***	0.129**	0.101*
	(0.0451)	(0.0816)	(0.0342)	(0.0597)	(0.0550)	(0.0605)
CDS $Start_{it}$	0.00784**	0.0279**	-0.000857	0.00649	-0.000917	-0.00877
	(0.00385)	(0.0124)	(0.00295)	(0.00826)	(0.00330)	(0.00767)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.175*		-0.0517		0.0600
		(0.0946)		(0.0734)		(0.0631)
Observations	1,735	1,735	2,425	2,425	1,270	1,270
M1(p)	0.000	0.001	0.000	0.000	0.001	0.000
M2(p)	0.13	0.138	0.773	0.683	0.334	0.379
Hansen(p)	1	0.429	1	0.999	1	1

Table 4.5 shows results using firm age as the proxy. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. The criterion for sample splitting has been shown in Table 1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Corresponding to calculations for firm liquidity, we also employ firm integrity to split our samples. Since the existence of information asymmetry, cash flow and coverage ratio sometimes do not tell the whole story and so firm integrity proxied by a firm's age or credit rating could be an efficient indicator for outsiders. After CDS trading, lenders may treat older and younger firms differently, on the part of credit supply easing, as well as high-grade and low-grade firms. Simultaneously, existing creditors attributed to the emergence of the CDS market could also have distinct attitudes to different groups. As a result, the CDS effects on investment and the investment-cash flow sensitivity may vary across groups, which are based on firm integrity.

Results of subsamples based on firm age are shown in table 4.5. We find that the coefficient estimate for CDS $Start_{it}$ in column (5) of panel A is negative and statistically significant, suggesting that integrity suspicious firms (younger firms) are inclined to reduce their investments after CDSs reference their debts. Economically, this reduction makes sense: compared with the sample mean of investment for younger firms (0.0728), the 0.00826 change in investment following CDS means an 11.35% decrease in the mean investment I_{it}/TA_{it-1}. In contrast, the coefficients on CDS $Start_{it}$ in columns (1) and (3) are small and insignificant, which signifies that the effect of CDS on investments are quite weak for integrity reliable and moderate firms. In respect to the investment-cash flow sensitivity, we only find a significant coefficient on $CF_{it}/TA_{it-1}\times$CDS $Start_{it}$ for integrity reliable firms (older firms). The negative sign shows that financial constraints for older firms are loosed due to the inception of the CDS market.

Panel B of table 4.5 reports the results when use the manufacturing sample. In column (1), the dummy of CDS $Start_{it}$ is positively correlated with investment and this correlation is significant at 5% confidence level. This indicates that older manufacturing firms increase their investments following the onset of CDS trading. However, this influence is not true for middle aged or younger firms. Moreover, column (2) shows that the coefficient on $CF_{it}/TA_{it-1} \times CDS\ Start_{it}$ is negative and significant, which represents the investment-cash flow sensitivity for older manufacturing firms decreases after the inception of CDS trading.

Table 4.6 Using credit rating as the integrity proxy

Panel A: Broad Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Integrity reliable		Integrity ordinary		Integrity suspicious	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.244***	0.239***	0.320***	0.255***	0.0470	0.181*
	(0.0834)	(0.0814)	(0.0815)	(0.0923)	(0.122)	(0.108)
Q_{it-1}	-2.49e-05	-0.000121	0.000240	-0.000171	0.000110	-0.00123
	(0.000291)	(0.000304)	(0.000453)	(0.000497)	(0.00109)	(0.00127)
CF_{it}/TA_{it-1}	0.235***	0.283***	0.246***	0.289***	0.462***	0.119
	(0.0416)	(0.0490)	(0.0521)	(0.0510)	(0.143)	(0.151)
CDS $Start_{it}$	-0.00653	0.0138**	-0.00196	-0.00822	-0.0119**	-0.0585**
	(0.00416)	(0.00611)	(0.00297)	(0.0109)	(0.00569)	(0.0247)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.121***		0.0296		0.563**
		(0.0416)		(0.0944)		(0.277)
Observations	2,935	2,935	5,859	5,859	2,889	2,889
M1(p)	0.001	0.001	0.000	0.000	0.000	0.024
M2(p)	0.118	0.126	0.366	0.24	0.702	0.916
Hansen(p)	1	1	0.962	0.104	0.906	0.539

Panel B: Manufacturing Sample	Dependent Variable: I_{it}/TA_{it-1}					
	Integrity reliable		Integrity ordinary		Integrity suspicious	
	(1)	(2)	(3)	(4)	(5)	(6)
I_{it-1}/TA_{it-2}	0.533***	0.452***	0.222**	0.311***	0.315***	0.299***
	(0.169)	(0.0822)	(0.110)	(0.0631)	(0.0794)	(0.0765)
Q_{it-1}	0.000188	0.000112	0.000532	0.000562	-0.000496	-0.000485
	(0.000346)	(0.000159)	(0.000444)	(0.000436)	(0.000503)	(0.000381)
CF_{it}/TA_{it-1}	0.0794	0.140***	0.0985**	0.0725**	0.259***	0.145**
	(0.0509)	(0.0393)	(0.0388)	(0.0324)	(0.0373)	(0.0642)
CDS $Start_{it}$	0.00766*	0.0176***	-0.00271	-0.00600	-0.00186	-0.000934
	(0.00448)	(0.00623)	(0.00238)	(0.00440)	(0.00521)	(0.00792)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.0993**		0.0116		0.0549
		(0.0408)		(0.0284)		(0.104)
Observations	1,384	1,384	2,705	2,705	1,341	1,341
M1(p)	0.002	0.001	0.001	0.000	0.004	0.004
M2(p)	0.989	0.982	0.157	0.243	0.113	0.137
Hansen(p)	0.347	1	0.981	1	1	1

Table 4.6 shows results using credit raing as the proxy. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. The criterion for sample splitting has been shown in Table 1. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 4.6 studies the CDS effects on investment and the investment-cash flow sensitivity conditional on firms' credit ratings. Similar to previous findings, the coefficient on interested variable (CDS $Start_{it}$) in column (5) of panel A is negative and significant at 5% confidence level. This evidence verifies that firms with low credit ratings have to reduce their investments for responding to the appearance of exacting creditors because of CDS trading. The reduction of investment is economically substantial. Relative to the sample mean I_{it}/TA_{it-1} of 0.0757, the 0.0119 lessening of investment after CDS trading represents a 15.72% decrease in the mean investment. Panel A of table 4.6 shows that the coefficient on $CF_{it}/TA_{it-1} \times$CDS $Start_{it}$ is negative and significant in column (2) but positive and significant in column (6). This indicates that the sensitivity of investment to cash flow decreases for firms with high credit ratings while it increases for firms with that low. Furthermore, it implies that creditors treat high and low rating firms differently when they lend and after lending.

We also use the manufacturing sample to replicate the analyses showed in Panel A and display the results in Panel B. We find that CDS trading increases the investment for integrity reliable firms (high credit rating firms here) but has little effect on integrity moderate or suspicious firms. In addition, the dependence of investment on cash flow is decreased for firms with high credit ratings while that is not obviously changed for medium or low credit rating firms. These results are highly robust to the findings when use firm age as the proxy for a firm's integrity.

4.3.4 The CDS impacts for excellent and inferior firms

Table 4.7 Using firm age and credit rating as the proxies

Panel A: Broad Sample	Dependent Variable: I_{it}/TA_{it-1}			
	Excellent firms		Inferior firms	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.298**	0.269**	0.124	0.143
	(0.117)	(0.116)	(0.120)	(0.116)
Q_{it-1}	3.72e-05	-0.000342	-0.000631	-0.000447
	(0.000278)	(0.000337)	(0.000596)	(0.000555)
CF_{it}/TA_{it-1}	0.238***	0.319***	0.332**	0.365**
	(0.0901)	(0.118)	(0.163)	(0.178)
CDS $Start_{it}$	0.000883	0.0255**	-0.0201**	0.00156
	(0.00670)	(0.0103)	(0.00858)	(0.0148)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.196***		-0.195
		(0.0731)		(0.172)
Observations	1,647	1,647	1,157	1,157
M1(p)	0.009	0.019	0.028	0.015
M2(p)	0.735	0.466	0.487	0.712
Hansen(p)	1	1	1	1

Panel B: Manufacturing Sample	Dependent Variable: I_{it}/TA_{it-1}			
	Excellent firms		Inferior firms	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.448***	0.418***	0.330***	0.339***
	(0.0731)	(0.0772)	(0.0526)	(0.0509)
Q_{it-1}	9.27e-05	6.53e-05	-3.29e-05	-5.26e-05
	(0.000208)	(0.000183)	(0.000370)	(0.000349)
CF_{it}/TA_{it-1}	0.0436**	0.0896***	0.134***	0.121***
	(0.0194)	(0.0290)	(0.0311)	(0.0309)
CDS $Start_{it}$	0.0152**	0.0207***	-0.0127***	-0.0108*
	(0.00646)	(0.00680)	(0.00486)	(0.00627)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.0663**		0.0313
		(0.0313)		(0.0656)
Observations	821	821	566	566
M1(p)	0.015	0.018	0.001	0.001
M2(p)	0.712	0.727	0.779	0.752
Hansen(p)	1	1	1	1

Table 4.7 uses firm age and credit rating to distinguish excellent and inferior firms. Excellent firms are older firms with high credit rating and inferior firms are younger firms with that low. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Generally speaking, external financers would not judge a firm by one dimension only. To relieve this concern, we construct subsamples having good or bad score in two dimensions. Table 4.7 uses the proxies firm age and credit rating to distinguish excellent and inferior firms. We define excellent firms as older firms with high credit ratings and inferior firms as younger firms with low ratings. Similarly, table 4.8 has excellent firms with high cash flows and credit ratings and inferior firms with low cash flows and credit ratings.

As shown in panel A of table 4.7, the coefficient estimate for CDS $Start_{it}$ in column (3) is negative and statistically significant, indicating that young firms with low ratings reduce their investments after the inception of CDS trading. For older firms with high credit ratings, the CDS effect on investment is positive but not significant. A probable reason may be that the benefit of credit easing and the need to raise cash, which both result from the onset of CDS market, offset one another. However, credit default swaps affect the sensitivity of investment to cash flow for excellent firms. Column (2) shows that the coefficient on $CF_{it}/TA_{it-1} \times$CDS $Start_{it}$ is negative and significant at 1% confidence level. This implies that financial constraints for older and high rating firms are loosened somehow.

Panel B reports the results for excellent and inferior firms using the manufacturing sample. An interesting finding is that the relationship between CDS trading and investment is positive and significant in column (1) but negative in column (3). These conflicting results reflect the different dominance in leverage increase and more cash reserves needed by firms. The leverage increase effect overwhelms the need for raising cash by excellent manufacturing firms and vice versa for inferior firms. This is because excellent manufacturing firms benefit more from credit easing but suffer less of a burden from the outcome of exacting creditors. We also find that excellent manufacturing firms depend less on cash flow to invest following the start of CDS trading.

Table 4.8 Using cash flow and credit rating as the proxies

Panel A: Broad Sample	Dependent Variable: I_{it}/TA_{it-1}			
	Excellent firms		Inferior firms	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.146*	0.159*	0.128**	0.158**
	(0.0823)	(0.0849)	(0.0577)	(0.0730)
Q_{it-1}	-0.000424	-0.000258	0.000307	5.51e-05
	(0.000292)	(0.000294)	(0.000542)	(0.000560)
CF_{it}/TA_{it-1}	0.245***	0.235***	0.276***	0.228***
	(0.0493)	(0.0592)	(0.0577)	(0.0811)
CDS $Start_{it}$	-0.00302	0.00773	-0.0232**	-0.0185*
	(0.00578)	(0.0102)	(0.00996)	(0.0102)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.0396		-0.0208
		(0.0570)		(0.0991)
Observations	1,269	1,269	1,194	1,194
M1(p)	0.022	0.029	0.039	0.008
M2(p)	0.677	0.822	0.22	0.237
Hansen(p)	1	1	1	1
Panel B: Manufacturing Sample	Dependent Variable: I_{it}/TA_{it-1}			
	Excellent firms		Inferior firms	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.378***	0.314**	0.293***	0.322***
	(0.112)	(0.137)	(0.0781)	(0.0344)
Q_{it-1}	-0.000108	-0.000559	-0.000559	1.05e-05
	(0.000199)	(0.000445)	(0.000503)	(0.000310)
CF_{it}/TA_{it-1}	0.133***	0.276***	0.190***	0.103*
	(0.0333)	(0.0779)	(0.0497)	(0.0600)
CDS $Start_{it}$	0.0128**	0.0374***	-0.0101**	-0.00580
	(0.00617)	(0.0121)	(0.00504)	(0.00431)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		-0.162***		0.00912
		(0.0625)		(0.0922)
Observations	797	797	611	611
M1(p)	0.004	0.006	0.009	0.005
M2(p)	0.805	0.925	0.374	0.692
Hansen(p)	1	1	1	1

Table 4.8 uses cash flow and credit rating to distinguish excellent and inferior firms. Excellent firms are those with high cash flows and credit ratings and inferior firms are those with low cash flows and credit ratings. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 4.8 shows the results for subsamples when use the proxies of cash flow and credit rating. Column (3) in panel A shows that the dummy CDS $Start_{it}$ is negatively and significantly correlated with the dependent variable, which suggests firms with both low cash flows and low credit ratings reduce their investments after the introducing of credit default swaps. Compared with the mean investment (0.0666) for inferior firms, the 0.0232 reduction in investment after CDS trading signifies a 34.83% decrease in the investment mean. The economic magnitude of this reduction is considerable. Unfortunately, we have not found significant coefficient on CF_{it}/TA_{it-1}×CDS $Start_{it}$ for either excellent or inferior firms.

We show estimates for manufacturing subsamples in panel B of table 4.8. As found in table 4.7, column (1) shows a positive coefficient on CDS $Start_{it}$ while column (3) shows a negative. Manufacturing firms with high cash flows and credit ratings could improve their leverages easier after CDS trading and simultaneously they have less incentive to reserve cash for resisting exacting creditors. As a result, they increase their investments after CDSs commence to referencing their debts. However, low cash flow and credit rating firms experience relatively less leverage increase but have to raise their cash holdings leading to a decrease in their investments. We find a negative coefficient on the interaction of CF_{it}/TA_{it-1} and CDS $Start_{it}$ in column (2) and it is significant at 1% confidence level. This negative sign indicates that the investment-cash flow sensitivity is decreased following CDS trading for excellent manufacturing firms.

4.3.5 Does the liquidity of CDS market matter?

In the previous analyses, we use CDS availability (a binary variable) to measure the

CDS impact on corporate investment and investment-cash flow sensitivity. The advantage for using that is to gauge the initiation time of each CDS clearly and focus on the changes this market brings to the economy. However, this key variable neglects the fact that liquidities of CDSs are different among our samples. If a CDS is not liquid, creditors cannot hedge their risks at lower cost and thus the incentive of increasing lending after CDS trading is weakened. Moreover, if a CDS buyer spends higher price to hedge his risk, he would be very tough in debt renegotiation. We re-estimate equation 4.1 and 4.2 using different measure and display results in table 4.9.

Table 4.9 Using CDS quotes number as the key variable

Dependent variable: I_{it}/TA_{it-1}	Broad Sample		Manufacturing Industry	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.242***	0.0128	0.352***	0.346***
	（0.0997）	(0.0749)	(0.0541)	(0.0526)
Q_{it-1}	-0.000605	-0.000836	-0.000441	-0.000179
	（0.000968）	(0.000882)	(0.000434)	(0.000303)
CF_{it}/TA_{it-1}	0.354***	0.328***	0.241***	2.14***
	（0.0875）	(0.0851)	(0.0368)	(0.0348)
CDS Quotes $Numbert_{it}$	-1.36e-06*	-1.14e-05**	3.78e-07	-2.95e-6**
	(7.11e-07)	(4.97e-06)	(6.15e-07)	(1.36e-6)
CF_{it}/TA_{it-1}×CDS Quotes $Number_{it}$		0.000104**		2.35e-05**
		(4.93e-05)		(1.15e-05)
Observations	11,683	11,683	5,430	5,430
M1(p)	0.012	0.025	0.000	0.015
M2(p)	0.931	0.177	0.101	0.103
Hansen(p)	0.272	0.388	0.115	0.302

Table A.5 shows results of equation 1 and 2 for the broad sample and the manufacturing industry. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS Quotes $Number_{it}$ is the total number of CDS quotes during year t. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Because CDSs are traded over the counter, it is extremely hard to measure their liquidity. Following Saretto and Tookes (2013), we calculate the overall number of CDS quotes during year t and use the natural log of that as the liquidity proxy. This measure directly takes CDS liquidity into the concern and shows its influence on our study. Table 4.9 shows that the coefficient estimate for CDS Quotes $Number_{it}$ in column (1) is negative and statistically significant. This suggests that the investment of reference firms decreases when there is a liquid CDS market. Column (2) shows that the coefficient on interaction of CDS Quotes $Number_{it}$ and CF_{it}/TA_{it-1} is positive and significant at 5% confidence level, indicating that, when there is a liquid CDS market, the firms are more dependent on their cash flows for investments. For the manufacturing sample, the emerge of a liquid CDS market has on significant effect on firms' investments. However, we still observe the positive and significant coefficient on the interaction term.

4.3.6 Does Financial Crisis matter?

The financial crisis in 2007 has had a tremendous shock to the world's economy. For the US CDS market, the nominal principle dropped dramatically from $58.24 trillion in 2007 (the peak) to $12.29 trillion by the end of 2015 (www.bis.org). With such a big fall, we cannot neglect the potential influence of the financial crisis on this research. Investors may view CDSs differently before and after the financial crisis, so we split our sample into two groups that before financial crisis and after financial crisis. Equations 4.7 and 4.8 are re-estimated using different subsamples and we display results in tables 4.10 and 4.11.

Table 4.10 Using the broad sample before and after the financial crisis (2007)

Dependent variable: I_{it}/TA_{it-1}	Broad Sample			
	Before 2007		After 2006	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.372***	0.374***	0.131	0.135
	(0.102)	(0.102)	(0.102)	(0.0940)
Q_{it-1}	-0.000232	-0.000171	0.00184*	-0.000214
	(0.000670)	(0.000666)	(0.00109)	(0.000641)
CF_{it}/TA_{it-1}	0.354***	0.350***	0.343***	0.504*
	(0.0791)	(0.0785)	(0.121)	(0.260)
CDS $Start_{it}$	-0.00314	-0.0146	-0.0149***	-0.00918
	(0.00235)	(0.0129)	(0.00565)	(0.0308)
CF_{it}/TA_{it-1} × CDS $Start_{it}$		0.113		0.5436**
		(0.116)		(0.268)
Observations	7,212	7,212	4,471	4,471
M1(p)	0.005	0.004	0.000	0.004
M2(p)	0.495	0.496	0.244	0.122
Hansen(p)	0.146	0.172	0.249	0.103

Table A.5 shows results of equation 1 and 2 for the broad sample and the manufacturing industry. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS Quotes $Number_{it}$ is the total number of CDS quotes during year t. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 4.11 Using the manufacturing sample before and after the financial crisis (2007)

Dependent variable: I_{it}/TA_{it-1}	Manufacturing Sample			
	Before 2007		After 2006	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.319***	0.332***	0.448***	0.443***
	（0.0618）	(0.0585)	(0.0602)	(0.0539)
Q_{it-1}	-0.000234	6.38e-05	5.86e-05	4.34e-05
	（0.000494）	(0.000347)	(0.000145)	(0.000143)
CF_{it}/TA_{it-1}	0.237***	0.203***	0.126***	0.0565
	（0.0438）	(0.0407)	(0.0360)	(0.0717)
CDS $Start_{it}$	0.00245	-0.00305	0.00159	-0.0230**
	(0.00239)	(0.00614)	(0.00302)	(0.00989)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		0.0426		0.187**
		(0.0467)		(0.0801)
Observations	3,380	3,380	2,050	2,050
M1(p)	0.000	0.000	0.000	0.000
M2(p)	0.174	0.190	0.096	0.079
Hansen(p)	0.157	0.121	0.189	0.503

Table A.5 shows results of equation 1 and 2 for the broad sample and the manufacturing industry. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS Quotes $Number_{it}$ is the total number of CDS quotes during year t. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 4.10 shows that the coefficient on CDS $Start_{i,t}$ is negative and significant at 1% confidence level in column (3) but insignificant in column (1). This suggests that before the financial crisis, the increased leverage can compensate the need of adding cash reserves. Nevertheless, this balance is broken after the financial crisis. Firms have to reduce investments to adapt the situation that the increasing of needed cash holding is more than that of leverage. The coefficients on the interaction of CDS $Start_{it}$ and CF_{it}/TA_{it-1} in column (2) and (4) tell the same story. The phenomenon that firms are more dependent on cash flow to invest after CDS trading is only significant for the period of post-financial crisis. Table 4.11 shows that the initiation of the CDS market has little effect on investment for manufacturing no matter before or after the financial crisis. However, we can readily find the coefficient estimate for the interaction term in column (4) of table 4.11 is positive and statistically significant. This indicates that manufacturing firms rely more on cash flow for their investments after the financial crisis.

4.4 Conclusion

In this chapter, we investigate the effects of credit default swaps (CDSs) on corporate investment and the sensitivity of investment to cash flow. Using a CRSP-Compustat and Markit merged sample, we find that the investment of reference firms, on average, is decreased and the firms depend more on cash flow to invest after the inception of CDS trading. The results are generally robust no matter whether we use the manufacturing sample or the broad sample including all industries. Considering that CDS effects may vary across groups, we split the samples by a variety of firm quality measures. We find that liquidity sufficient firms and integrity reliable firms increase their investments and have lower investment-cash flow sensitivity following the introduction of credit default swaps, while liquidity constrained firms and integrity suspicious firms reduce that and exhibit higher sensitivity.

According to Augustin et al. (2016), to fully understand how CDSs affect a firm's creditors and shareholders, it is essential to investigate the true impact of CDS trading on the firm's behavior such as investment. This chapter fills that gap and, to our knowledge, we are the first to explore the CDS effects on corporate investment and the investment-cash flow sensitivity. Moreover, we empirically examine the model proposed by Bolton and Oehmke (2011), which claims CDS trading generates tough creditors and influences a firm's investment. Furthermore, we link the ex-ante CDS effect of leverage increasing verified by Saretto and Tookes (2013) and the ex-post CDS effect of more cash reserve needing discussed by Subrahmanyam et al. (2017) and study the dominance mechanism between these two effects. We find that these distinguish excellent firms from inferior firms and lead to different financial outcomes. This suggests that sometimes we cannot discuss benefits or disadvantages of CDSs simply on average.

In general, the creation of credit derivatives is thought to be helpful in the economy. Greenspan (2004) concludes that credit derivatives contribute to a more efficient, resilient, and flexible financial system. Nevertheless, our results show the emergence of the CDS market reducing investment in the corporate sector. In addition, liquidity constrained firms and integrity suspicious firms that suffer from financial constraints and need external funds are adversely affected by CDS trading.

These findings suggest a need for regulators to be flexible in making policies regarding credit default swaps. On the one hand, CDSs genuinely enhance welfare for some economic entities: increasing investments for excellent firms and loosening their financial constraints. Thus, it is not sensible to limit the development of the CDS market or deprive voting rights of CDS-protected creditors in debt renegotiation. On the other hand, CDSs worsen the plight of weaker firms: making it harder for them to implement investments and be more dependent on their cash flows. Thus, addressing the problem of exacting creditors is highly necessary. A balanced policy for CDSs is called for and we hope future studies can give further evidence.

Chapter 5

Credit Default Swaps, Dividend Policy and the Signaling Role of dividends

5.1 Introduction

The credit default swaps (CDSs) market emerged at the end of the last century and has attracted considerable academic interest. The effects, real or potential, of CDSs on corporate finance have been widely investigated. For example, CDS use is found to affect corporate structure (Saretto and Tookes, 2013), corporate default probability (Subrahmanyam et al., 2014), and corporate cash holding (Subrahmanyam et al., 2017). However, these studies focus only on the change of creditor-shareholder relationship resulting from CDS trading. As a tool for transferring risk, CDSs may also affect the relationship between managers and minority shareholders. In this research, we study the impacts of credit default swaps on dividend policy and the signaling role of dividends.

The impetus for our study is that credit default swaps help banks to lay off their credit risk, thus reducing their concern for monitoring loans (Parlour and Winton, 2013). This variation weakens the protection from banks to minority shareholders. Easterbrook (1984) claims that a significant purpose of introducing external financing is to subject management to monitoring. Without this, outside shareholders lose the opportunity to be free riders and managers' incentives are altered on dividend payments. According to

Jensen (1986), a rationale for paying dividends is to lessen the agency problem derived from the separation of control and ownership. The varying of third-party protection breaks the initial balance between two counterparties. La Porta et al. (2000) propose the substitute theory that firms under worse legal protection pay more dividends to build their reputations for external financing. If this theory works, we can expect that firms are inclined to pay, increase and continue to pay dividends after the introduction of CDS trading. Moreover, “empty creditors” may also help to increase the propensities for dividend payments following CDS trading. Bolton and Oechmke (2011) show that these empty creditors, who are insured against default but retain voting rights, are tougher in debt renegotiations, especially when they hold large CDS positions. Thus, following the referencing of firms’ debts by CDSs, those firms go into bankruptcy more easily, or offer greater compensation for financial distress, and management faces higher risk and cost for investing in negative NPV projects. The incentive towards “empire building” lessens and is replaced by a push towards cash disbursements.

There may also be a CDS impact in the opposite direction. We start with the same idea that the emergence of a CDS market reduces third-party protection for outside shareholders. If the outcome theory (La Porta et al., 2000) holds, firms become less likely to pay, increase and continue to pay out cash. The theory suggests that firms under strong legal protection pay more dividends because their minority shareholders can readily use legal rights to pressure firms. Moreover, management caution towards exacting creditors reduces the probability of dividend payments, increases and continuities. Subrahmanyam et al. (2017) show that reference firms choose to increase their cash reserves after predicting the adverse effect from exacting creditors. This conservative practice can affect investment as well as dividend policy. Internal funds are valuable due to their low costs compared with external funds. If firms would have to consume internal capital to build extra cash reserves, they have incentives to reduce cash distribution. The ultimate CDS impact on dividend policy will be determined by these conflicting effects and we will need to discover which dominates. Considering the CDS impact may vary with the severity of agency conflict, we also separately investigate that by groups.

Why might CDSs influence the signaling role of dividends? Because they change managers' incentive to pay dividends. Based on the substitute theory, after CDS trading has started, the underlying firm seeks to compensate for the reduced third-party protection by using dividend policy. Thus, compared with the situation without CDS trading, dividends are used less for the purpose of signaling future growth. Conversely, the outcome theory indicates that firms with decreased monitoring after CDS trading are given greater freedom to use their free cash flows. Consequently, if referenced firms pay dividends following the emergence of the CDS market then they must expect stronger income expansion in the future. In other words, the forecasting efficiency of dividends is strengthened. Due to the variation in dividend information content, we also expect a CDS effect on stock responses to dividend announcements.

The substitute theory of La Porta et al. (2000) suggests that firms in a worse environment of investor protection are more likely to pay dividends to compensate this weakness. Moreover, exacting creditors accompanying with the onset of CDS trading (Bolton and Oechmke, 2011) put a pressure on managers keeping them from negative NPV projects. Thus, more free cash flows would be used to give cash disbursements. Based on these logics, we have the following hypothesis:

Hypothesis 1a: CDS reference firms are more likely to pay, increase and continue to pay dividends following the induction of CDSs.

On the other hand, the outcome theory (La Porta et al., 2000) predicts that investors under poor legal protection cannot readily use rights to pressure firms. As a result, managers would have less incentive to give dividend payments. Additionally, Subrahmanyam et al. (2017) show that managers have to increase cash reserves to defend exacting creditors reducing the money can be used as cash disbursements. From this point of view, we proceed to the following alternative hypothesis:

Hypothesis 1b: CDS reference firms are less likely to pay, increase and continue to pay dividends following the induction of CDSs.

CDSs change managers' incentives to pay dividends and the connotation of that as well. Based on the substitute theory, dividends are used less, after CDS trading, for the purpose of signaling future growth. However, the outcome theory implies that if managers pay dividends without outside pressure, they must expect strong income expansion in the future. So, we have two alternative hypotheses for the CDS impact on the signaling role of dividends as follows:

Hypothesis 2a: The signal role of dividends is weakened after the onset of CDS trading.

Hypothesis 2b: The signal role of dividends is strengthened after the onset of CDS trading.

We construct a p score matched sample to investigate the impact of CDSs on dividend policy and the signaling role of dividends. With the similar characters to receive CDS trading, p score matched non-CDS firms are more reasonable than other non-CDS firms using as the benchmark. We find, on average, that reference firms become more likely to pay, increase and continue to pay their dividends following the introduction of CDSs. Results are robust after controlling for firm-specific features affecting dividend policy, fixed firm effects and fixed time effects. We construct several subsamples for studying whether the CDS effects vary across groups and find that firms with higher free cash flows, older firms and larger firms are more affected by CDS trading. In addition, we find strong evidence for CDS trading reducing the signaling role of dividends.

This chapter contributes to the literature in two strands. It adds to the literature on dividend policy by introducing the impact of CDS trading. Our results support the substitute theory and are in accordance with findings of Rozeff (1982), Fenn and Liang (2001) and Gan et al. (2011) that firms with weak protection are more willing to make dividend payments. Additionally, our work links to Easterbrook (1984), Grullon et al. (2002), Jagannathan and Stephens (2003) and DeAngelo et al. (2006), due to the evidence we find for the agency and the life-circle theory of dividends. This study sheds light on the CDS impact on corporate behavior, particularly dividend policy. Augustin et al. (2016) propose that a deep understanding of how CDSs affect firms' creditors and shareholders is needed. Our findings suggest that CDSs affect not only the relation between creditors and shareholders but also that between controlling and outside shareholders. This relates to Bolton and Oechmke (2011), Saretto and Tookes (2013) and Subrahmanyam et al. (2017).

The rest of this chapter is organized as follows. Section 5.2 presents the methodology of our study. Section 5.3 describes data. Section 5.4 provides empirical results and analyses of CDS impacts on dividend policy, the signaling role of dividends and stock responses to dividend announcements. Section 5.5 concludes.

5.2 Methodology

5.2.1 The effect of CDSs on dividend policy

Our main interest is to investigate the impact of CDS use on corporate payout policy. More specifically, we examine how probabilities of dividend payments, increases, continuities and decreases change after the emergence of the CDS market. To implement our tests, the following models are employed.

$$Pr(Dividend\ payments)_{i,t} = c + \beta_1 CDS\ Start_{i,t} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.1)$$

$$Pr(Dividend\ increases)_{i,t} = c + \beta_1 CDS\ Start_{i,t} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.2)$$

$$Pr(Dividend\ continuities)_{i,t} = c + \beta_1 CDS\ Start_{i,t} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.3)$$

$$Pr(Dividend\ decreases)_{i,t} = c + \beta_1 CDS\ Start_{i,t} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.4)$$

Dividend payments is the first dependent variable that equals 1 if the firm i pays a dividend in the time t, 0 otherwise. Dividend increases is a binary variable that is given value 1 if a firm's dividend payment this year is more than in the previous year. For firms continuously pay dividends in year t-1 and year t, dividend continuities equals 1, 0 otherwise. The variable of dividend decreases equals 1 when firms pay lower dividend than they did in the previous year. Our focus is the dummy variable CDS $Start_{it}$, which equals 1 in the onset year of CDS trading and years after, 0 otherwise.

Earlier studies show that a series of factors can affect firms' dividend policy making, so we include control variables which are common in the literature into our specifications to remove potential influences. First, we include firm size (natural log of the firm's total assets) to control for the general ability to distribute cash. Large firms can most easily obtain external financing and have probably less investment opportunity, so they are more likely to pay, increase and continue to pay dividends. Leverage ratio (total liability over total assets) is used to control for the extent of financial strain. Firms with high leverages facing capital pressure readily reduce or omit dividend payouts. To control for the influence of profitability on dividend policy, we employ ROA (operating income over total assets) into our models; highly profitable firms are more willing to pay cash to their shareholders (Shao et al., 2010). We expect ROA to be positively related to dividend payments, increases and continuities.

We include growth (one-year sales growth) and Tobin's q (market value to book value) to control for firms' investment opportunities. Firms blessed with abundant investment opportunities may be reluctant to pay or continue to pay dividends because internal funds are so valuable for them. However, benefiting from the opportunities, they have high probability of investing in positive NPV projects and generate sufficient cash flows to increase dividends. Thus, we predict the coefficients on growth/Tobin's q are negative when we use Pr(dividend payments) and Pr(dividend continuities) as dependent variables but positive when Pr(dividend increases) is considered. We also include cash holding (cash and short-term investment over total assets) to control for the capital adequacy. Firms with greater cash holdings find it easier to pay, increase and continue to pay dividends. Following Ben-Nasr (2015), Louis and Urcan (2015), we use RE ratio (retained earnings over common equity) to control for the life stage of a firm. The life-cycle theory suggests that firms with high RE ratio are in the stage of maturity, with sufficient money but few investment opportunities, and thus highly likely to disgorge cash. Furthermore, all of our specifications include firm fixed effects and time fixed effects to eliminate the concern of existing year and time-invariant firm differences.

5.2.2 Sample separation standard

The agency problem between managers and outside shareholders raises the concern that insiders will proceed with negative NPV projects for building their own empires, requiring dividend payouts. An instinctive idea is that firms with higher free cash flows need to grant more cash disbursements than firms with lower free cash flows. For this reason, we expect that the impact of CDSs on dividend policy varies with different levels of firms' free cash flows. Since CDSs reduce banks' incentives to monitor lenders, they are seen as harmful to investor protection. If the outcome theory works, firms will have lower probability to pay, increase and continue to pay dividends and this effect is stronger for firms with lower free cash flows. However, if substitute theory works, firms are more inclined to pay, increase and continue to pay dividends; and this effect is stronger for firms with higher free cash flows. Following Lang et al. (1991) and Chan (2006), we calculate free cash flows as operating income before depreciation minus interest expense, minus taxes and minus total dividends, taken over the total assets in the last year. Based on this measure, our p score matched sample is divided into two groups with lower free cash flows and higher free cash flows. The former group is for firm-year observations whose free cash flows are below the medium level of peers in the same industry and the same year while the latter is for firm-year observations whose free cash flows are above.

The life-cycle theory of dividends tells us that firms in their earlier stages have few internal funds but numerous investment opportunities, so they are less likely to pay, increase and continue to pay dividends. As time goes by, firms become more profitable but with weaker growth momentum, not needing to hold so much capital and starting to distribute their cash to shareholders. Therefore, we may infer that older firms face higher agency costs than younger ones and this difference might affect the influence of CDSs on dividend policy. The first year in which financial data appear in the Compustat database is identified as a firm's earliest year and we use this baseline to calculate the firm's age. Then, we split the sample into groups of younger firms and older firms. Similar to the criterion for free cash flow, we assign firm-year observations whose ages are below the medium age of their peers in the same industry and year into the younger firm group while the rest are assigned to the older.

Firm size could be another factor relevant to the agency conflict. Larger firms always have complex ownership structure, various investor types and many shareholders. All these three dimensions aggravate the conflict between insiders and outsiders. Conversely, managers of smaller firms hold most shares and also have close relationships with other investors. This must be helpful in eliminating distrusts and reducing agency costs. Considering this divergence, we hypothesize the impact of CDS use on dividend policy may depend on firm size. A firm-year is allocated to the small firm group if its firm size is smaller than the medium of firm-years in the same industry and year and vice versa.

5.2.3 The influence of CDS on the signaling role of dividends

Another interest of our research is to investigate the influence of CDSs on the signaling role of dividend policy. The literature suggests that firms use dividends as a positive signal to indicate their bright futures to outsiders and, due to the high cost of dividends, this signal is reliable. Since CDS trading may affect firms' behaviors in dividend policy, we have sufficient reason to consider its influence on the signaling role of dividend policy. If the outcome theory applies, firms after inception of CDS trading have less pressure to pay dividends and so such payments would be more correlated with the prediction of future earnings growth. However, if the substitute theory works, the signaling role of dividends after CDS trading should become weaker and less exact. To complement our tests, the following models are used.

$$(I_{i,t} - I_{i,t-1})/BVE_{i,t-2} = \mathrm{c} + \beta_1 Dividend\ payments_{i,t-1} + \beta_2 CDS\ Start_{i,t-1} + \beta_3 Dividend\ payments_{i,t-1} \times CDS\ Start_{i,t-1} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.5)$$

$$(I_{i,t} - I_{i,t-1})/BVE_{i,t-2} = \mathrm{c} + \beta_1 Dividend\ increases_{i,t-1} + \beta_2 CDS\ Start_{i,t-1} + \beta_3 Dividend\ increases_{i,t-1} \times CDS\ Start_{i,t-1} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.6)$$

$$(I_{i,t} - I_{i,t-1})/BVE_{i,t-2} = \mathrm{c} + \beta_1 Dividend\ continuities_{i,t-1} + \beta_2 CDS\ Start_{i,t-1} + \beta_3 Dividend\ continuities_{i,t-1} \times CDS\ Start_{i,t-1} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.7)$$

$$(I_{i,t} - I_{i,t-1})/BVE_{i,t-2} = \mathrm{c} + \beta_1 Dividend\ decreases_{i,t-1} + \beta_2 CDS\ Start_{i,t-1} + \beta_3 Dividend\ decreases_{i,t-1} \times CDS\ Start_{i,t-1} + \Sigma\, \beta_j\, Control\ variables_j + \alpha_i + \alpha_t + \varepsilon_{it}. \quad (5.8)$$

We use $I_{i,t}$ to denote a firm's income before extraordinary items after dividend policy made in the year t-1 and $BVE_{i,t-2}$ to denote a firm's book value of equity one year before. Dependent variable $(I_{i,t} - I_{i,t-1})/BVE_{i,t-2}$ measures changes of firms' earnings. Dividend $payments_{i,t-1}$, Dividend $increases_{i,t-1}$, Dividend $continuities_{i,t-1}$, Dividend $decreases_{i,t-1}$ and CDS $Start_{i,t-1}$ are indicators defined in the same way as previously. We create interactions of CDS $Start_{i,t-1}$ with four dividend indicators to investigate the change of dividend's signaling role after CDS trading. Following Nissim and Ziv (2001) and Aggarwal et al. (2012), we use ROE_{t-1} (operating income over book value of equity) and $(I_{i,t-1} - I_{i,t-2})/BVE_{i,t-2}$ as our control variables. Because earnings are mean-reverting, we predict that the coefficients on these two variables are positive. Firm fixed effects and time fixed effects are also considered in our models.

5.3 Data

Markit and CRSP-Compustat are the two sources used to build our sample for studying the impact of CDSs on a firm's dividend policy and its signaling role. To identify firms whose debts are referenced by credit default swaps and the inception times, we obtain daily CDS quotes from the Markit CDS database. Markit gives CDS valuations every day according to their survey results from different CDS broker dealers. We use the first appearance time of a CDS denominated in US dollars with five years maturity as the inception time of CDS trading for its reference firm. The CDS sample period is from 2001, when Markit starts records, to 2014. The information on dividend, income and control variables are obtained from CRSP-Compustat annual database. Following earlier studies on dividends, we remove financial firms from our sample. All firm-year observations are required to have no missing values for all interested variables. To eliminate concerns with outliers, we windsorize all variables at the 1th and 99th percentiles.

Table 5.1 summarizes the statistics of the main variables for our p score matched sample. We display the overall statistics summary in column 1. Since subsamples are used in some analyses, we also give statistics summaries on different groups. Columns 2 and 3 show means and standard deviations of variables for firms with higher free cash flows and firms with lower free cash flows. Columns 4 and 5 report for younger firms and older firms while columns 6 and 7 describe groups of smaller and larger firms.

Table 5.1 Summary statistics

Dependent variable:	All	Lower Free Cash Flows	Higher Free Cash Flows	Younger	Older	Smaller	Larger
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dividend Payments	0.6771539	0.5375169	0.7726297	0.5870333	0.7353615	0.5680236	0.7706954
	(0.46757)	(0.49862)	(0.41915)	(0.49239)	(0.44116)	(0.49537)	(0.4204)
Dividend Increases	0.5669277	0.4430222	0.6364937	0.5131058	0.6041053	0.4848889	0.6372477
	(0.49551)	(0.49677)	(0.48103)	(0.49985)	(0.4891)	(0.4998)	(0.48081)
Dividend Continuities	0.6571328	0.5160787	0.7517889	0.5625334	0.7196598	0.5471446	0.7514097
	(0.4747)	(0.49977)	(0.43199)	(0.4961)	(0.44918)	(0.4978)	(0.43221)
Dividend Decreases	0.1313914	0.1272765	0.1420394	0.115973	0.1374714	0.1216513	0.1397401
	(0.33784)	(0.3333)	(0.34911)	(0.32021)	(0.34436)	(0.3269)	(0.34673)
Firm Size	7.977989	7.203238	8.814865	7.615035	8.221406	6.987449	8.827035
	(1.6261)	(1.419072)	(1.3158)	(1.677842)	(1.5727)	(1.4063)	(1.2859)
Leverage	0.5957685	0.6069688	0.5965654	0.5865096	0.5977401	0.5860532	0.6040949
	(0.20053)	(0.22526)	(0.18133)	(0.22358)	(0.19562)	(0.22414)	(0.17741)
ROA	0.1416366	0.1218429	0.1569105	0.1414781	0.1429622	0.1369887	0.1456276
	(0.08883)	(0.09846)	(0.07658)	(0.09501)	(0.08667)	(0.10337)	(0.07387)
Tobin's Q	2.974737	2.663707	3.370858	2.904166	3.019543	2.84674	3.084572
	(4.261)	(4.4328)	(4.3282)	(4.333)	(4.1321)	(4.5879)	(3.956)
Growth	0.0886792	0.0924707	0.0840928	0.1116041	0.0729776	0.094224	0.0840141
	(0.23027)	(0.26042)	(0.19895)	(0.24987)	(0.21511)	(0.25047)	(0.21168)
Cash Holding	0.0957278	0.1016214	0.091063	0.100716	0.0950737	0.1040876	0.0885616
	(0.1232)	(0.13793)	(0.11025)	(0.12835)	(0.12047)	(0.13908)	(0.10723)
RE	0.4708801	0.2465016	0.6436263	0.3339936	0.5675286	0.342213	0.5811526
	(2.6622)	(3.2013)	(2.2901)	(2.8293)	(2.7231)	(2.9296)	(2.4041)

Observations	22,726	9,609	11,180	9,347	12,228	10,489	12,237

This table displays descriptive statistics for our p score matched sample and subsamples. Column 1 gives overall statistics summary. Columns 2 and 3 report for firms with higher free cash flows and firms with lower free cash flows. Columns 4 and 5 report for younger firms and older firms while columns 6 and 7 describe groups of smaller and larger firms. The group lower cash flows is for firm-year observations whose free cash flows are below the medium level of firms' in the same industry and the same year while the group higher cash flows is for firm-year observations whose are above. The group younger is for firm-year observations whose ages are blow the medium age of their peers in the same industry and year while the rest firm-year observations are assigned to the older group. The group Smaller is for firm-year observations whose firm sizes are minor than that medium of firm-years in the same industry and year and vice versa. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity.

Column 1 shows that the probability of paying dividends for our p score matched sample is about 67.72%, confirming the importance of dividends as a cash disbursement form. More than half of firm-years increase their dividend payouts compared to the previous years. Considering that CDS and their matched firms are always mature and superior, this number is no surprise. Large and profitable firms have high probability to receive CDS trading (Subrahmanyam et al. (2014). Column 1 also reports that the possibility of continuing to pay dividends is high, in accordance with the theory of sticky dividends. Firms normally do not reduce or omit dividend payments and the corresponding probability is only 13.14% for our sample.

Subsample statistics summaries provide some crude evidence for the agency and the life-cycle theories. Compared to firms with lower free cash flows, firms with higher flows are more likely to pay, increase and continue to pay dividends; and the differences are quite large. This supports the idea that the significance of dividend payments is to remove the worry that management will misuse internal funds. Consistent with the life-cycle theory, older firms have higher probability of dividend payments, increases and continuities than younger firms. Moreover, the ratio of retained earnings is much higher for older firms while the growth rate is substantially lower, implying that they have accumulated excessive profits and face high agency costs. Taking firm size into account, smaller firms pay and increase their dividends less frequently and are inclined to discontinue such payments. This is in line with our expectation that smaller firms face slighter information asymmetries relative to larger firms, benefitting from their simple ownership structures and close relationships with investors. Another interesting finding is that larger firms have weaker sales growth but greater Tobin's Q, challenging the homogeneity of two indicators. We explain this by the “larger firm preference” of investors in the stock market.

5.4 Empirical Results

In this section, we first study the empirical relationship between the onset of CDS trading and corporate dividend policy. We then extend our research to whether this relationship is affected by different levels of free cash flows, firm ages and firm sizes, taking agency problem into consideration. For robustness testing, we investigate the impact of CDSs on dividend payouts rather than probabilities of different dividend policies, using a series of deflators. Moreover, we present evidence that CDSs can influence the signaling role of dividends. Lastly, we explore the change of stock responses to dividend announcements after introducing CDSs. To remove the concern of endogeneity, we use the method of propensity score matching.

5.4.1 propensity score matching

An endogeneity problem could exist in our study because we do not know whether the timing of CDS trading onset is exogenous or not. It is probable that CDS trading begins while market participants predict the future changes of firms’ dividend policies. Although controlling for fixed firm effects can partially solve the problem, we still need to attend to this issue more directly. Following Ashcraft and Santos (2009), Subrahmanyam et al. (2014), Arentsen et al. (2015) and Amiram et al. (2017), we use propensity score matching to relieve the concern of CDS self-selection. Roberts and Whited (2013) comment that propensity score matching is one of the most popular methods to solve endogeneity problem because of its simple matching methodology.

P score matching is used to solve self-selection bias and is popular in the research of studying “treatment effect”. For example, someone wants to identify the function of medical treatment and gets health scores for some individuals. If he compares directly between two groups “go to hospital” and “do not go to hospital”, he will get the biased conclusion that medical treatment is harmful to human health. It is because people go to hospital normally have lower health scores than ones do not go to hospital and there exists self-selection. Non-CDS reference firms are less visible and face sever information asymmetries than CDS reference firms (Subrahmanyam et al., 2014). Thus, the probability to pay dividends is higher for the former. Without p score matching, we may find that firms are reluctant to pay dividends after CDS trading. However, it is due to a self-selection bias not the true “treatment effect”.

We employ a probit model to estimate the propensity to receive CDS trading. Data from the first quarter of 2001 to the first quarter of each CDS trading are used for CDS reference firms and we include all data throughout our sample period for non-CDS firms. The dependent variable is binary, equaling 0 before the inception of CDS trading and 1 thereafter. For non-CDS firms, this dependent variable is always equal to 0. Control variables are firm size (natural log of firms’ total assets), leverage (total liability over total assets), firm sales (natural log of the firm’s sales), cash holding (cash and short-term investment over total assets), Tobin’s q (market value to book value), ROA (operating income over total assets), RE (retained earnings over common equity), WCAP (working capital over total assets), IB (income before extraordinary items over total assets) and EBIT(earnings before interest and tax over total assets).

We then use coefficients from the estimation of the probit model to predict propensity scores for firm matching. For each CDS firm, we identify one non-CDS firm that is the nearest neighbor using replacement and a caliper of 0.01. Compared with all non-CDS firms, p score matched non-CDS firms are more effective as the benchmark because they are similar to CDS firms on the perspective of receiving CDS trading.

5.4.2 Empirical relationships between CDS trading and dividend policy

Table 5.2 The CDS impact on dividend policy

Dependent variable:	Dividend Payments	Dividend Increases	Dividend Continuities	Dividend Decreases
	(1)	(2)	(3)	(4)
Firm Size	1.149***	0.717***	1.273***	-0.0316
	(0.0553)	(0.038)	(0.0585)	(0.0419)
Leverage	-2.105***	-2.120***	-1.798***	1.539***
	(0.213)	(0.171)	(0.217)	(0.188)
ROA	6.438***	8.074***	5.184***	-3.527***
	(0.523)	(0.43)	(0.521)	(0.429)
Tobin's Q	0.0175**	0.0140**	0.0166**	-0.00998*
	(0.00765)	(0.00553)	(0.00778)	(0.00596)
Growth	-1.050***	0.733***	-1.120***	-1.705***
	(0.142)	(0.101)	(0.146)	(0.121)
Cash Holding	-0.21	-0.243	-0.745*	-0.284
	(0.413)	(0.31)	(0.435)	(0.367)
RE	0.0644***	0.0423***	0.0640***	0.00493
	(0.0113)	(0.00921)	(0.0116)	(0.00914)
CDS Start	0.500***	0.236***	0.612***	0.0501
	(0.112)	(0.0766)	(0.114)	(0.0858)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	9,487#	18,138	9,015	17,222

This table shows the impact of CDSs on firms' dividend policies. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Fixed firm effect logit model drops observations with all positive outcomes. Since dividend payments/continuities is stickier than dividend increases/decrease, the former one is dropped more and has small observations. We include a robustness check using fixed time effects and cluster by firm on page 215. Four columns of that have same observations and results are not changed.

Table 5.2 presents our main results for the impacts of CDSs on firms' probabilities of dividend payments, increases, continuities and decreases. Column (1) shows that the coefficient on CDS Start is positive and significant at 1% confidence level. This indicates that firms are more likely to pay dividends after introducing CDSs compared to matched non-CDS firms and themselves before CDS trading. Moreover, the coefficient estimate for CDS Start in column (2) is positive and statistically significant too, which suggests that the probability of dividend increases goes up after the onset of CDS trading. These two pieces of evidence support the substitute theory and imply that firms use dividends to relieve the concern of inadequate bank monitoring due to CDS trading. The other possible explanation could be that the existence of "empty creditors" scares managers and takes them away from negative NPV projects, leading to more willingness towards cash distribution. The coefficient on CDS Start in column (3) hints that dividends become stickier once credit default swaps are involved, despite already being sticky at first. The CDS influence is not obvious on the probability of dividend decrease since the coefficient on CDS Start in column (4) is not significant even at 10% confidence level.

Coefficients on other factors are mostly as expected in section 5.2. Firms with bigger size, higher return on assets and larger RE ratio are more likely to pay, increase and continue to pay their dividends. Leverage is negatively related with the probability of dividend payments, increases and continuities but positively with that of decreases. Sales growth does reduce the propensity for dividend payment and continuing payment while simultaneously raising that for dividend increase. This is consistent with the theory that internal funds are more valuable for firms having abundant investment opportunities and the firms are given more power to generate cash for increasing dividends. The effect of cash and short-term investment on dividend policy is insignificant. The one surprising finding is that coefficients on Tobin's Q are positive for dividend payments, increases and continuities. Reasons could be that firms with superior market valuation also have higher free cash flows and we have already controlled for sales growth in our specifications.

Table 5.3 The CDS impact on dividend policy with different free cash flows

Dependent variable:	Dividend Payments		Dividend Increases		Dividend Continuities		Dividend Decreases	
	Lower Free Cash Flows	Higher Free Cash Flows	Lower Free Cash Flows	Higher Free Cash Flows	Lower Free Cash Flows	Higher Free Cash Flows	Lower Free Cash Flows	Higher Free Cash Flows
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm Size	1.194***	1.121***	0.822***	0.718***	1.368***	1.149***	-0.0382	-0.115
	(0.0886)	(0.106)	(0.0687)	(0.0644)	(0.096)	(0.107)	(0.0731)	(0.0748)
Leverage	-2.301***	-2.202***	-2.208***	-2.092***	-2.006***	-1.770***	1.189***	2.170***
	(0.314)	(0.407)	(0.268)	(0.282)	(0.332)	(0.412)	(0.289)	(0.324)
ROA	4.771***	8.602***	6.739***	8.255***	3.713***	5.915***	-3.429***	-3.210***
	(0.795)	(0.998)	(0.726)	(0.663)	(0.821)	(0.957)	(0.67)	(0.693)
Tobin's Q	0.0233*	0.0143	0.0166*	0.0123	0.0242*	0.0178	-0.0071	-0.0209**
	(0.012)	(0.0129)	(0.00939)	(0.00784)	(0.0126)	(0.013)	(0.00977)	(0.00861)
Growth	-1.125***	-1.200***	0.226	1.268***	-1.033***	-1.502***	-0.992***	-2.414***
	(0.2)	(0.267)	(0.156)	(0.161)	(0.211)	(0.269)	(0.177)	(0.199)
Cash Holding	-2.075***	1.233*	-0.765	0.226	-2.869***	0.568	-0.755	0.0911
	(0.644)	(0.708)	(0.489)	(0.48)	(0.702)	(0.726)	(0.558)	(0.594)
RE	0.0626***	0.0478**	0.0525***	0.0284**	0.0521***	0.0591***	-0.00113	0.00279
	(0.0161)	(0.0186)	(0.0158)	(0.0125)	(0.0168)	(0.0188)	(0.0136)	(0.013)
CDS Start	0.123	0.644***	0.0101	0.338***	0.196	0.861***	0.148	-0.127
	(0.173)	(0.19)	(0.131)	(0.112)	(0.181)	(0.19)	(0.145)	(0.126)
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,975	3,649	6,444	9,103	3,700	3,602	6,132	8,533

The table displays the CDS impacts on firms' dividend policies based on different free cash flows. The group lower cash flows is for firm-year observations whose free cash flows are below the medium level of firms' in the same industry and the same year while the group higher cash flows is for firm-year observations whose are above. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Managers may have stronger incentive to invest unprofitable projects for empire building when their firms have higher free cash flows. Outsiders exhibit deeper concern for firms under this condition. As a result, if investors deem that CDSs are averse to investor protection because of a lack of bank monitoring, this perspective will be confirmed particularly for firms with higher free cash flows.

Table 5.3 presents empirical results for our models for firms with lower and higher free cash flows. Table 5.3 shows that the coefficient on CDS Start in column (1) is insignificant while that in column (2) is positive and significant at 1% confidence level. This apparent inconsistency suggests that the propensity for paying dividends does not change for firms with lower free cash flows but increases for firms with higher cash flows after the inception of CDS trading. This is in line with our expectation, higher free cash flows firms facing severer outside distrust are more easily affected by CDS trading. Similarly, the coefficient on CDS Start in column (4) is very significant while that in column (3) is not. This finding indicates that firms with higher free cash flows, following the emergence of named firm CDSs, tend to increase their dividend payouts but firms with lower flows do not. Coefficients on the CDS Start in columns (5) and (6) tell us that dividends only become stickier for higher free cash flow firms when credit default swaps are involved. The influence of CDS use on firms' probability of dividend decreases is not obvious, although it is positive for firms with lower free cash flows but negative for firms with higher free cash flows.

Table 5.4 The CDS impact on dividend policy with different firm ages

Dependent variable:	Dividend Payments		Dividend Increases		Dividend Continuities		Dividend Decreases	
	Younger	Older	Younger	Older	Younger	Older	Younger	Older
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm Size	1.236***	1.486***	0.742***	0.795***	1.383***	1.490***	0.101	0.0815
	(0.106)	(0.0839)	(0.0745)	(0.054)	(0.112)	(0.0842)	(0.08)	(0.0617)
Leverage	-2.834***	-2.165***	-2.483***	-2.294***	-2.292***	-1.917***	1.044***	1.762***
	(0.386)	(0.302)	(0.307)	(0.24)	(0.385)	(0.308)	(0.329)	(0.267)
ROA	4.825***	7.889***	5.916***	9.246***	3.500***	6.545***	-1.395**	-5.302***
	(0.901)	(0.811)	(0.746)	(0.604)	(0.906)	(0.792)	(0.63)	(0.63)
Tobin's Q	0.018	0.0347***	0.0199**	0.00799	0.0155	0.0422***	-0.0175	-0.0103
	(0.0124)	(0.0129)	(0.00997)	(0.00794)	(0.0126)	(0.0134)	(0.0106)	(0.00863)
Growth	-0.996***	-1.114***	0.672***	0.954***	-0.953***	-1.142***	-1.759***	-1.894***
	(0.232)	(0.213)	(0.168)	(0.144)	(0.24)	(0.214)	(0.202)	(0.168)
Cash Holding	-1.260*	1.243**	-0.7	0.0762	-1.938**	0.4	-0.146	-0.0391
	(0.749)	(0.571)	(0.568)	(0.422)	(0.775)	(0.58)	(0.65)	(0.516)
RE	0.0426***	0.0726***	0.0499***	0.0290**	0.0287*	0.0848***	-0.017	0.013
	(0.0165)	(0.0179)	(0.0164)	(0.0116)	(0.0167)	(0.0187)	(0.0171)	(0.0117)
CDS Start	-0.234	0.503***	-0.0512	0.268**	0.0204	0.621***	-0.166	0.0156
	(0.194)	(0.165)	(0.146)	(0.107)	(0.196)	(0.166)	(0.166)	(0.119)
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Observations	3,508	4,863	6,198	10,184	3,401	4,625	5,692	9,639

The table displays the CDS impacts on firms' dividend policies based on different firm ages. The group younger is for firm-year observations whose ages are blow the medium age of their peers in the same industry and year while the rest firm-year observations are assigned to the older group. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Compared with younger firms, older firms have regular profits but fewer investment opportunities, leading to superior capability for cash distribution. Facing the adverse impact of CDSs on investor protection, younger firms may be unable to frequently pay or increase their dividends for hedging while older firms can. It is reasonable, then, to predict that the CDS effect on dividend policy is more pronounced for older firms.

Table 5.4 reports the results for the subsamples based on firms' ages. We find that the coefficient, in column (1), on CDS Start for younger firms is negative while that, in column (2) for older firms is positive and highly significant. This signifies that older firms having sufficient retained earnings more frequently pay dividends after CDS trading but younger firms with limited paying ability even reduce the frequency after that. This divergence is caused by the varying of firm status with firm age and is consistent with the life cycle theory. The coefficient on CDS Start in column (3) is insignificant but that in column (4) is positively significant implying that only older firms have higher probability of increasing dividends after the CDS market appears. Younger firms' internal funds are insufficient to finance their investing opportunities so it is hard to increase dividend payouts despite showing CDS impact. On the perspective of dividend continuities, older firms are more willing to continue paying dividends after CDS trading while this behavior is not obvious for younger firms. The coefficients on CDS Start in columns (7) and (8) are both insignificant, showing the probability of dividend decreases is not changed after the onset of CDS trading.

Table 5.5 The CDS impact on dividend policy with different firm sizes

Dependent variable:	Dividend Payments		Dividend Increases		Dividend Continuities		Dividend Decreases	
	Smaller	Larger	Smaller	Larger	Smaller	Larger	Smaller	Larger
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm Size	1.222***	1.177***	0.715***	0.795***	1.419***	1.158***	0.0254	-0.0785
	(0.0916)	(0.0994)	(0.0673)	(0.0623)	(0.0988)	(0.0993)	(0.0742)	(0.0729)
Leverage	-2.197***	-2.552***	-2.060***	-2.547***	-2.027***	-2.175***	1.260***	2.275***
	(0.311)	(0.361)	(0.262)	(0.266)	(0.329)	(0.356)	(0.292)	(0.297)
ROA	4.975***	7.310***	5.991***	9.874***	3.862***	5.446***	-2.922***	-5.130***
	(0.74)	(0.869)	(0.635)	(0.649)	(0.757)	(0.818)	(0.608)	(0.673)
Tobin's Q	0.00845	0.0168	0.0108	0.0143*	0.00252	0.0264*	-0.0019	-0.0224**
	(0.0111)	(0.0129)	(0.00839)	(0.00825)	(0.0116)	(0.0136)	(0.00895)	(0.00878)
Growth	-1.104***	-1.059***	0.274*	1.162***	-1.127***	-1.258***	-1.077***	-2.212***
	(0.213)	(0.219)	(0.159)	(0.143)	(0.221)	(0.223)	(0.182)	(0.177)
Cash Holding	-0.713	0.489	0.0707	0.0375	-1.484**	-0.171	-1.354**	0.219
	(0.605)	(0.697)	(0.458)	(0.481)	(0.658)	(0.704)	(0.546)	(0.567)
RE	0.0676***	0.0604***	0.0431***	0.0388***	0.0628***	0.0749***	-0.00261	0.00324
	(0.0177)	(0.018)	(0.016)	(0.0124)	(0.0188)	(0.0186)	(0.0151)	(0.012)
CDS Start	0.146	0.630***	0.00447	0.375***	0.131	0.850***	0.209	-0.198
	(0.182)	(0.178)	(0.133)	(0.11)	(0.19)	(0.178)	(0.148)	(0.123)
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Observations	4,089	4,257	7,048	9,960	3,846	4,044	6,591	9,341

The table displays the CDS impacts on firms' dividend policies based on different firm sizes. The group Smaller is for firm-year observations whose firm sizes are minor than that medium of firm-years in the same industry and year and vice versa. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Firm size can also affect the impact of CDS use on a firm's dividend policy. Relative to smaller firms, larger firms face higher agency costs due to their decentralized ownership structures and more distant relationships with outside investors. In the absence of bank monitoring, larger firms can find it hard to use their private channels to appease all investors, as smaller firms do, and a simpler way for them is to choose dividend payments as an alternative. Consequently, the impact may be heavier on larger firms than on smaller firms.

We display empirical results depending on different firm sizes in table 5.5. We find that the coefficient estimate for CDS Start in column (1) is insignificant but in column (2) is positively significant at 1% confidence level. This suggests that larger firms are more inclined to pay dividends after CDSs commence to reference their debts. Smaller firms do not behave in the same way. A probable reason is that smaller firms can exploit their close ties with outsiders to eliminate adverse CDS shocks and do not need to use dividends. The coefficient on CDS Start in column (4) is significant while that in column (3) is not, which indicates that the effect of CDS on dividend increases in probability is quite weak for smaller firms but strong for larger firms. In respect to dividend continuities, we only find a significant coefficient on CDS Start in column (6) for larger firms. The positive sign shows that larger firms find it even harder to omit dividend payments following the onset of CDS trading. According to columns (8) and (9), the initiation of the CDS market neither affects the probability of dividend decreases for smaller firms nor for larger firms.

Table 5.6 The CDS impact on dividend payout ratio

Dependent variable:	DIV/TA	DIV/MV	DIV/SHO	DIV/NI
	(1)	(2)	(3)	(4)
Firm Size	0.00199***	0.00257***	0.206***	0.0504***
	(0.000254)	(0.000565)	(0.011)	(0.0157)
Leverage	0.00833	0.0423	0.361	0.264
	(0.00608)	(0.0287)	(0.231)	(0.271)
ROA	0.0974***	0.0312*	1.418***	-0.0466
	(0.0102)	(0.0162)	(0.273)	(0.369)
Tobin's Q	0.000711***	-0.00110**	-0.00615	-0.00576
	(0.0002)	(0.000533)	(0.00733)	(0.0111)
Growth	-0.0205***	-0.0235***	-0.528***	-0.311*
	(0.00189)	(0.00452)	(0.0799)	(0.167)
Cash Holding	0.0103**	0.00377	-0.206	-0.0993
	(0.00476)	(0.0197)	(0.196)	(0.377)
RE	0.00109***	0.000268	0.0231	0.0270**
	(0.000303)	(0.00045)	(0.0145)	(0.0121)
CDS Start	0.00104**	0.00139**	0.0750***	-0.0189
	(0.000439)	(0.000671)	(0.0216)	(0.0332)
CDS Firm	-0.00143*	-0.000403	-0.0496	0.0642
	(0.000803)	(0.0023)	(0.0344)	(0.0584)
R-squared	0.188	0.126	0.181	0.022
Observations	21,487	21,487	21,487	21,486

This table presents the CDS impact on corporate payout ratio. We employ four measures for the ratio that DIV/TA (dividend amounts over total assets), DIV/MV (dividend amounts over market value of equity), DIV/SHO (dividend amounts over common shares outstanding) and DIV/NI (dividend amounts over net income). Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. CDS Firm takes 1 for CDS firms, 0 otherwise. The Fama-Macbeth approach is used for estimations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

For robustness testing, we investigate the impact of CDS use on firms' dividend payout ratios. Following the literature, we employ four measures for the ratio that DIV/TA (dividend amounts over total assets), DIV/MV (dividend amounts over market value of equity), DIV/SHO (dividend amounts over common shares outstanding) and DIV/NI (dividend amounts over net income). Control variables are as defined previously and the variable of interest is still CDS Strat that equals 0 before CDS trading, 1 for other situations. We apply the Fama-Macbeth approach, which estimates regressions year by year using cross-sectional data and we calculate the average slope for each regressor to obtain our results. The binary variable CDS Firm that takes 1 for CDS firms, 0 otherwise is included to control for time-invariant difference between CDS and non-CDS firms.

Table 5.6 displays the CDS effect on firms' dividend payout ratios using different deflaters. Column (1) in table 5.6 shows that the coefficient on CDS Start is positive and statistically significant. This evidence verifies that firms pay more dividends after CDSs commence to reference their debts than before and their matched non-CDS firms. Similarly, the coefficient on CDS Start, in column (2), is significant and we use the same symbol. The increase in this ratio of dividend payout is economically substantial. Relative to the sample mean DIV/MV of 0.0196, the 0.0014 rise after the emergence of the CDS market represents a 7.14% growth in the mean dividend payout. The coefficient estimate for CDS Start in column (3) is still positive and significant at 1% confidence level, which suggests that dividends per share are increased following the onset of CDS trading. These are in accordance with the finding in table 2 and support the dividend substitute theory. However, the effect of CDS use on dividend deflated by net income is obscure because the coefficient on CDS Start in column (4) is insignificant.

We obtain similar estimates for control variables as in table 5.2. Larger firms and firms with strong profitability pay more dividends. Sales growth that represents a firm's investment opportunity is negatively correlated with dividend payouts. Mature firms with substantial retained earnings distribute more cash to their shareholders. The influences of other variables Leverage, Tobin's Q and Cash on dividend payouts are mixed and opaque. Coefficients on CDS Firm are either insignificant or weakly significant verify the success of our p score matching.

5.4.3 Results for the CDS impact on the signaling role of dividends

Table 5.7 The CDS impact on the signaling role of dividends

Dependent variable:	$I_{i,t}-I_{i,t-1}/BVE_{i,t-2}$			
	(1)	(2)	(3)	(4)
ROE_{t-1}	0.0139***	0.0139***	0.0139***	0.0139***
	(0.00386)	(0.00386)	(0.00386)	(0.00386)
$I_{i,t-1}-I_{i,t-2}/BVE_{i,t-2}$	-0.169***	-0.169***	-0.169***	-0.169***
	(0.00369)	(0.00369)	(0.00369)	(0.00369)
CDS $Start_{i,t-1}$	0.184*	0.0904	0.151	-0.00977
	(0.108)	(0.0913)	(0.105)	(0.0755)
Dividend $Payments_{i,t-1}$	0.0442			
	(0.0798)			
Dividend $Payments_{i,t-1}$ × CDS $Start_{i,t-1}$	-0.290**			
	(0.114)			
Dividend Increases		0.0629		
		(0.0588)		
Dividend $Increases_{i,t-1}$ × CDS $Start_{i,t-1}$		-0.197**		
		(0.0979)		
Dividend Continuities			0.0373	
			(0.0803)	
Dividend $Continuities_{i,t-1}$ × CDS $Start_{i,t-1}$			-0.251**	
			(0.111)	
Dividend $Decreases_{i,t-1}$				-0.00158
				(0.0692)
Dividend $Decreases_{i,t-1}$ × CDS $Start_{i,t-1}$				-0.0665
				(0.133)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
R-squared	0.099	0.098	0.098	0.098
Observations	20,718	20,718	20,718	20,718

This table shows the impact of CDS on dividend's signaling role. $I_{i,t}$ denotes a firm's income before extraordinary items after dividend policy made in the year t-1 and $BVE_{i,t-2}$ to denote the firm's book value of equity one year before. Dependent variable $(I_{i,t} - I_{i,t-1})/BVE_{i,t-2}$ measures changes of firms' earnings. ROE_{t-1} is operating income over book value of equity. $(I_{i,t-1} - I_{i,t-2})/BVE_{i,t-2}$ is earning changes in the year t-1 over book value of equity in the year t-2. Dividend $payments_{i,t-1}$, Dividend $increases_{i,t-1}$, Dividend $continuities_{i,t-1}$, Dividend $decreases_{i,t-1}$ and CDS $Start_{i,t-1}$ are indicators defined same as previously. We create the interactions between dividend policies and CDS Start that Dividend Payments × CDS Start, Dividend Increases × CDS Start, Dividend Continuities × CDS Start and Dividend Decreases × CDS Start. Firm fixed effects and time fixed effects are controlled. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Our previous empirical results show that firms are more inclined to pay, increase and continue to pay dividends after the inception of CDS trading. However, this effect is due to the incentive of hedging reduced third-party protection resulting from lack of bank monitoring. Since dividends can also be used as signaling devices to show firms' bright futures, we are interested to explore whether the signaling role of dividends is weakened by the changed incentive following CDS trading. To study the impact of CDS use on the signaling role of dividends, we create the interactions between dividend policies and CDS Start: Dividend Payments × CDS Start, Dividend Increases × CDS Start, Dividend Continuities × CDS Start and Dividend Decreases × CDS Start.

As shown in column (1) of table 5.7, the coefficient on Dividend Payments × CDS Start CDS Start is negative and statistically significant, indicating that the signaling role of dividend payments is attenuated after the onset of CDS trading. This is consistent with our expectation that after CDS trading has commenced, dividends act more as compensations for reduced protection rather than as signaling devices and thus the relation between dividend payment and future earnings growth becomes impotent. Dividend increase is another signal for firms' coming excellent performances but we discover that this forecasting function has also been weaken following the start of the CDS market. The coefficient estimate for Dividend Increases × CDS Start is negative and significant at 5% confidence level proposing direct evidence. Simultaneously, we find that the coefficient on Dividend Continuities × CDS Start uses the same symbol and is significant as well supporting the argument of decreasing signaling role. The coefficient estimate for Dividend Decreases × CDS Start implies that the effect of CDS use on the sensitivity of future income changes to dividend decreases is not clear.

5.4.4 Does the liquidity of CDS market matter?

In the previous analyses, we use CDS availability (a binary variable) to measure the CDS impact on dividend policies. The advantage for using that is to gauge the initiation time of each CDS clearly and focus on the changes this market brings to the economy. However, this key variable neglects the fact that liquidities of CDSs are different among our samples. If a CDS is not liquid, buyers may have to spend higher price to hedge his risk and would be very tough in debt renegotiation making exacting creditor more "exacting". We re-estimate equation 5.1, 5.2, 5.3 and 5.4 using different measure and display results in table 5.8.

Table 5.8 Robustness check using CDS quotes number as the key variable for the chapter 5

Dependent variable:	Dividend Payments	Dividend Increases	Dividend Continuities	Dividend Decreases
	(1)	(2)	(3)	(4)
Firm Size	1.138***	0.715***	1.258***	-0.0328
	(0.0551)	(0.0379)	(0.0582)	(0.0419)
Leverage	-2.096***	-2.120***	-1.785***	1.542***
	(0.213)	(0.171)	(0.217)	(0.188)
ROA	6.397***	8.054***	5.137***	-3.545***
	(0.522)	(0.430)	(0.521)	(0.429)
Tobin's Q	0.0175**	0.0140**	0.0167**	-0.00996*
	(0.00765)	(0.00552)	(0.00778)	(0.00596)
Growth	-1.041***	0.736***	-1.106***	-1.703***
	(0.141)	(0.101)	(0.145)	(0.121)
Cash Holding	-0.200	-0.227	-0.726*	-0.263
	(0.411)	(0.310)	(0.434)	(0.367)
RE	0.0646***	0.0422***	0.0645***	0.00498
	(0.0113)	(0.00920)	(0.0116)	(0.00915)
CDS Quotes Number	0.0578***	0.0284***	0.0700***	-0.000392
	(0.0152)	(0.0103)	(0.0153)	(0.0116)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	9,487	18,138	9,015	17,222

This table shows the impact of CDSs on firms' dividend policies. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Because CDSs are traded over the counter, it is extremely hard to measure their liquidity. Following Saretto and Tookes (2013), we calculate the overall number of CDS quotes during year t and use the natural log of that as the liquidity proxy. This measure directly takes CDS liquidity into the concern and shows its influence on our study. Column (1) of table 5.8 shows that the coefficient on CDS Quotes Number is positive and significant at 1% confidence level. This indicates that firms are more likely to pay dividends when there is a liquid CDS market. Moreover, the coefficient estimate for CDS Quotes Number in column (2) is positive and statistically significant too, which suggests that the probability of dividend increases goes up if CDSs can be easily traded. The coefficient on CDS Quotes Number in column (3) hints that dividends become stickier once a liquid CDS market emerges.

5.4.5 Does Financial Crisis matter?

The financial crisis in 2007 has a tremendous shock to the world's economy. For the US CDS market, the nominal principle dropped dramatically from $58.24 trillion in 2007 (the peak) to $12.29 trillion by the end of 2015 (www.bis.org). With such a big fall, we cannot neglect the potential influence of the financial crisis on this topic. Investors may view CDSs differently before and after the financial crisis, so we split our sample into two groups that before financial crisis and after financial crisis. Equations 5.1, 5.2, 5.3 and 5.4 are re-estimated by including the interaction of CDS Start and the period after the financial crisis. Relevant results are represented in table 5.9.

Table 5.9 The CDS impact on dividend policies considering the financial crisis (2007)

Dependent variable:	Dividend Payments	Dividend Increases	Dividend Continuities	Dividend Decreases
	(1)	(2)	(3)	(4)
Firm Size	1.178***	0.730***	1.308***	-0.0391
	(0.0559)	(0.0382)	(0.0593)	(0.0420)
Leverage	-2.128***	-2.106***	-1.816***	1.519***
	(0.213)	(0.171)	(0.217)	(0.188)
ROA	6.477***	8.070***	5.233***	-3.511***
	(0.522)	(0.430)	(0.520)	(0.429)
Tobin's Q	0.0176**	0.0140**	0.0162**	-0.00969
	(0.00769)	(0.00555)	(0.00781)	(0.00596)
Growth	-1.074***	0.723***	-1.144***	-1.701***
	(0.142)	(0.101)	(0.146)	(0.121)
Cash Holding	-0.222	-0.272	-0.736*	-0.268
	(0.413)	(0.311)	(0.436)	(0.367)
RE	0.0654***	0.0428***	0.0647***	0.00498
	(0.0114)	(0.00926)	(0.0117)	(0.00916)
CDS Start	0.0331	-0.0398	0.113	0.251**
	(0.143)	(0.0963)	(0.144)	(0.116)
After 2006	-2.744***	-2.361***	-3.237***	1.653**
	(0.623)	(0.463)	(0.629)	(0.759)
CDS Start × After 2006	0.881***	0.527***	0.951***	-0.337**
	(0.167)	(0.113)	(0.168)	(0.132)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	9,487	18,138	9,015	17,222

This table shows the impact of CDSs on firms' dividend policies. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table 5.9 shows that the coefficient on the interaction of CDS Start and the period after 2006 is positive and significant at 1% confidence level. This indicates that compared to the period before the financial crisis, firms whose debts are referenced by CDSs are more likely to pay dividends in the period after. This is consistent with the fact that creditors are become more cautious after the financial crisis and the concern of reduced third-party protection is aggravated. As a result, managers have to increase the frequency of cash disbursement to relieve this worrying. Coefficients on the interaction term in column (2) and (3) tell the same story. CDS reference firms have higher propensities to increase and continue to pay dividend during the period of post-financial crisis. The coefficient estimate for the interaction term in column (4) suggests that CDS reference firms has lower probability to reduce dividends after the financial crisis relative to the time before.

5.5 Conclusion

This chapter adds to the literature on dividend policy by investigating the impact of introducing named firm credit default swaps (CDSs). In the conflict between managers and outside shareholders, creditors can protect shareholders, as free-riders, by monitoring managers' misuse of internal funds. However, creditors entering into CDSs have reduced interest in monitoring. This weakening of third-party protection might influence dividend policy. Indeed, we find exactly that, with firms more likely to pay, increase and continue to pay their dividends following the introduction of named firm CDSs. The evidence is robust even after controlling for firm-specific characters that affect dividend policy, firm fixed effects and time fixed effects.

Agency conflicts appear to exert considerable influence on the CDS effect, with firms having higher free cash flows, older firms and larger firms being more severely affected by credit default swaps. We also find that firms pay more dividends after the start of CDS trading no matter whether we use total assets, market value of equity, or common shares outstanding as the deflator. Notably, the signaling role of dividends is weakened after CDSs commence to reference firms' debts.

Our results may be interpreted according to several previously proposed mechanisms explaining behaviors of firms. Thus, reduced creditor monitoring that results from CDS trading leads to weaker third-party protection. To ease the worry of outside shareholders facing this change, firms can use dividends as a hedging measure, consistent with the substitute theory. Moreover, we present evidence that firms with larger agency costs and ages are more sensitive to the possibility of negative shocks, in line with agency theory and life-cycle theory. Dividends are effectively commitments not to misuse internal funds, which is amplified for CDS reference firms. Then, after CDS trading has been initiated, dividends are used more for increasing trust among shareholders.

This chapter indicates that the emergence of the CDS market brings about higher cash disbursement. This helps to redistribute wealth in the society and improves the efficiency of capital conducing to a more healthy, flexible and strong economy. However, due to the high cost of dividends, using them to hedge the negative shock towards investor protection could be a heavy burden for some firms. It is advisable for regulators to introduce policies to balance the trade-off between benefits and costs coming from credit default swaps.

Chapter 6

Summary

6.1 Introduction

This chapter is to present our findings and contributions of investigating the effects of CDS availability on debtors, borrowers and the economy they compose. The rest of chapter is organized into three sections as follows. Section 6.2 gives a summary of our research findings. Section 6.3 shows contributions of this study. Section 6.4 provides policy implications of our work.

6.2 Summary of our findings

Table 6.1 summarizes the questions and answers of this study and we show our main findings below:

Chapter 3 examines the impact of CDS trading on the yield spread between corporate and Treasury bonds. Our results suggest that CDSs affect the yield spread both negatively and positively. The overall impact is correlated with firms' credit conditions when they issue bonds. This finding is robust no matter what credit proxy is used. This means that, on average level, the CDS impact is hard to identify. To separate these two opposite impacts, we split the samples by firms' leverages or credit rating numbers at bond issue times. In accordance with our theoretical model, we find that after CDS trading begins, the yield spread decreases when firms issue bonds during good credit periods but increases during bad credit periods for the firms. We also consider the potential endogeneity problem that CDS trading may begin while market participants predict the future changes of the yield spread. Propensity score matching is employed and we obtain similar results.

Table 6.1 Research questions and answers

Research Questions	Answers
How do the negative and the positive CDS channels affect the yield spread?	The negative CDS channel affects the yield spread through providing a new hedging opportunity while the positive one comes to force by creating empty creditors and reducing bank monitoring.
Does the CDS effect on the yield spread vary with firms’ credits on issue times?	Yes. Using leverage and rating numbers as the proxy, we find the CDS effect significantly interacts with firms' credits when they issue bonds.
Does the negative CDS effect outweigh the positive during good credit periods and vice versa?	Yes. During good credit periods, lenders would view CDS availability as a candy because the new hedging opportunity is the dominant force. Nevertheless, during bad credit periods, lenders would view CDS trading as a shock since empty creditor problem and less bank monitoring are more noticeable.
Is the emergence of the CDS market conducive to increasing private sector investment?	No. Reference firms reduce their investments, on average, after the beginning of the CDS market.
Does the increase of corporate leverage after CDS trading really loosen financial constraints faced by firms?	No. The increased leverage after CDS trading has not been effectively used to relieve financial constraints. We find firms become more dependent on their internal funds to invest.

Do CDSs affect investment and the investment-cash flow sensitivity differently towards to good and bad liquidity/integrity firms?	Yes. Liquidity sufficient and integrity reliable firms increase their investments and have lower investment-cash flow sensitivity following the introduction of credit default swaps, while liquidity constrained and integrity suspicious firms reduce that and have higher sensitivity.
Do CDSs change the relationship between managers and outside shareholders?	Yes. CDSs weaken banks' incentives to monitor borrowers making outside shareholders lose the opportunity to be free riders. It actually undermines their third-party protections and amplifies the agency problem.
How the reduced third-party supervision affects managers' incentives towards dividend policy?	If the outcome theory holds, reduced third-party supervision will give managers more freedom to use internal funds leading to low interest to pay dividends. However, if the substitute theory works, managers would try to compensate minority shareholders contributing to high propensity to distribute cash.
Have CDSs altered the purpose of dividend payments?	Yes. Compared to dividends before CDS trading, that after more act as compensations for reduced third-party protection rather than signals of future earnings growth.
Do investors in the stock market care about the change of dividends' information content?	No. After CDS trading, stock responses to dividend announcements have not significantly changed. Investors in the stock market probably consider dividends as short-term rewards rather than long-term signals.

Chapter 4 studies whether corporate investment and the investment-cash flow sensitivity change following the emergence of a CDS market. We find that reference firms, on average, reduce their investments and rely more heavily on cash flow to invest after the onset of CDS trading. The manufacturing sample and the broad sample of all industries exhibit generally consistent results. Considering that CDS effects on investment and the sensitivity may vary across groups, we split the samples by a variety of firm quality measures. The results show that decreased investment and the higher sensitivity following the introduction of CDSs are more pronounced for firms with lower cash flows or coverage ratios. Additionally, we find that older firms and firms owning better credit ratings, compared with their counterparties, are less likely to reduce investments and less dependent on internal funds after the beginning of CDS trading. Our findings also suggest that CDSs can increase investment and loosen financial constraints for a part of firms, which have good liquidity or integrity, especially using the manufacturing sample.

Chapter 5 investigates the effect of credit default swaps (CDSs) on corporate dividend policy. The results show that firms after CDSs commence to reference their debts have higher propensity to pay, increase and continue to pay dividends. This is robust after controlling for firm-specific dividend related characters, firm fixed effects and time fixed effects. Due to the significance of agency conflict to dividend policy, we expect the CDS effect could also be affected by the severity of that conflict. Three proxies, firms' free cash flows, ages and sizes, are used to divide the sample. We find that firms with higher free cash flows, older firms and larger firms are heavily affected by credit default swaps while firms with lower free cash flows, younger firms and small firms are not. Our research extends to study of the effect of CDSs on firms' dividend payouts afterwards. The results suggest that firms pay more dividends following CDS availability no matter whether we use total assets, market value of equity, or common shares outstanding to be the deflator. Moreover, our analysis indicates that the signaling role of dividends is weakened after the commencement of CDS trading.

6.3 Contributions of this thesis

The objective of our research is to explore how the emergence of the CDS market affect incentives and behaviors of participants in the economy. The specific contributions can be found in chapter 3, 4 and 5. In this section, we stress the main contributions of this thesis.

First, the thesis links the CDS market to the bond issue market and shows opposing choices of lenders facing different credits of issuers at issue time. This contributes to a better understanding that the impact of CDSs on debt pricing is multifaceted and hard to identify in a single way. Our findings suggest that if firms issue bonds during their good credit periods, CDS availability affects yield spread through the negative channel due to the creation of new hedging opportunity. This is consistent with the expectation that CDSs benefit the economy by reducing financing costs. However, if firms issue bonds during their bad credit periods, the CDS impact acts contrarily because investors are concerned about the adverse outcome of the empty creditor problem and less bank monitoring. This supports the literature proposing that CDS trading increases the system risk of the whole financial market.

To fully understand the impact of CDS availability, you have to focus on changes in firms' behaviors after the beginning of the market (Augustin et al., 2016). Our study pays attention to how CDSs affect firms' investment behaviors and their dependences on internal funds which, to our knowledge, has never been accessed before. It directly tests the model proposed by Bolton and Oehmke (2011), which implies a change of corporate investment after the inception of the CDS market. Moreover, our study contributes to Saretto and Tookes (2013) and Subrahmanyam et al. (2017) since we link the two CDS effects that both increased leverage and cash reserve and examine the dominance mechanism between them. Our findings indicate that increased cash reserve requirement overwhelms increased leverage on average.

Our research not only studies the influence of CDSs on debtors and creditors but also that on managers and minority shareholders. For their own safety, banks seek to prevent managers from taking overly risky or unprofitable investments. This potentially gives minority shareholders a third-party protection that managers cannot unscrupulously misuse internal funds. However, CDS availability changes banks' incentives for monitoring, weakening the protection. Our study specializes in this alteration and adds to the literature by introducing CDS use to the investigation of firms' dividend policies. Our results support the substitute theory that managers use dividends as compensation for weaker outside protection. Moreover, our work is in line with the agency theory and the life-cycle theory due to the evidence that firms with larger agency costs and ages are more sensitive facing negative shocks. Furthermore, this thesis emphasizes the importance of dividend as commitments of not misusing internal funds, especially for CDS reference firms.

CDSs, as financial innovations, are expected to construct a better economy. Greenspan

(2004) concludes that credit derivatives contribute to a more efficient, resilient, and flexible financial system. However, criticisms of the emergence of the CDS market have not eased since the financial crisis of 2007. This thesis provides a multidimensional view of CDS impacts on the economy and its participants, contributing to a better understanding how a financial innovation brings both benefits and costs to the real world.

6.4 Policy implications

This study has several implications for policy makers. To start with, the impacts of CDS availability on the economy and financial markets are manifold. It is unwise to make a coarse decision to promote or suppress the development of the CDS market. On the one hand, CDSs create a new hedging opportunity, build an information channel, increase credit supply and reduce financing costs that helps to improve welfares of some economic entities. On the other hand, they weaken bank monitoring, generate empty creditors, aggravate agency conflicts and diminish corporate investments, leading to high risk of reference assets and firms. We suggest regulators make a balanced policy for the CDS market considering both its pros and cons and use flexible regulations for CDS buyers and sellers according to different reference bodies.

Second, policy makers should understand that all CDS impacts originate from the alteration of participants' behaviors after CDS trading. To make correct policy, regulators need to pay attention to changes in incentives of economic entities. As instruments for transferring risk, CDSs break the unity of beneficial right and risk exposure. This affects creditors' payoffs when a default happens. Creditors become reluctant to supervise borrowers and even prefer to see them go into bankruptcy. Borrowers, in turn, have different choices in daily operation and corporate governance. These changes are worth reading in depth. An ideal policy is to keep advantageous effects but peel off adverse ones, such as limiting vote weights of creditors whose CDS positions are over debts they hold.

Third, financial innovations like CDSs have characters of producing risks and bubbles. Although promoting the business economy, they always exceed the equilibrium for a social planner who attempts to maximize profits for all parties. For example, the buyer does not need to own the reference asset while doing a particular CDS transaction. This encourages speculation and may lead to huge amounts of trades not for hedging. In the end, it is not just a risk shift but a risk amplification. Bankruptcy of CDS sellers will cause a chain reaction in the financial market, greatly increasing the system risk. Moreover, CDS sellers are not required to hold reserves for protections they sell and even be qualified financial institutions. This will increase the level of risk preference and generate a series of irrational behaviors. For regulators, it is advisable to supervise a financial innovation at the first time and do necessary experiments on it for finding reasonable policies and regulations.

References

Acharya, V. V. and T. C. Johnson. 2007. Insider trading in credit derivatives. *Journal of Financial Economics* 84: 110-141.

Aggarwal, R., J. Cao, and F. Chen. 2012. Information environment, dividend changes, and signaling evidence from ADR firms. *Contemporary Accounting Research* 29(2): 403-31.

Alexander, G., A. Edwards, and M. Ferri. 1998. 'Trading volume and liquidity in Nasdaq's high-yield bond market', unpublished manuscript, Securities and Exchange Commission, Washington, D.C.

Allayannis, G. and A. Mozumdar. 2004. The impact of negative cash flow and influential observations on investment-cash flow sensitivity estimates. *Journal of Banking and Finance* 28: 901–930.

Altman, E. and D. Kao. 1992. The Implications of Corporate Bond Rating Drift. *Financial Analysts Journal* 48(3): 64-75.

Amiram, D., W. H. Beaver, W. R. Landsman, and J. Zhao. 2017. The effects of credit default swap trading on information asymmetry in syndicated loans. *Journal of Financial Economics* 126: 364-82.

Arellano, M. and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58(2): 277–297.

Arentsen, E., D. C. Mauer, B. Rosenlund, H. H. Zhang, and F. Zhao. 2015. Subprime mortgage defaults and credit default swaps. *Journal of Finance* 70: 689-731.

Ashcraft, Adam B. and Joao A. C. Santos. 2009. Has the CDS market lowered the cost of corporate debt? *Journal of Monetary Economics* 56: 514-23.

Atanassov, J. and E. Kim. 2009. Labor laws and corporate governance: International evidence from restructuring decisions. *Journal of Finance* 64: 341-74.

Augustin, P., M. Subrahmanyam, D. Tang, and S. Wang. 2016. Credit default swaps: past, present, and future. Annual Review of Financial Economics 2016(8):10.1-10.22

Bae, S. C., K. Chang, and E. Kang. 2012. Culture, corporate governance, and dividend policy: international evidence. *Journal of Financial Research* 35(2): 289-316.

Ball, R. and L. Shivakumar. 2005. Earnings quality in UK private firms: Comparative loss recognition timeliness. *Journal of Accounting and Economics* 39(1): 83-128.

Bao, J., J. Pan, and J. Wang. 2011. The illiquidity of corporate bonds. *Journal of Finance* 66(3): 911-946.

Ben-Nasr, H. 2015. Government ownership and dividend policy: evidence from newly privatized firms. *Journal of Business Finance and Accounting* 42(5-6): 665-704.

Blanco, R., S. Brennan, and I. W. Marsh. 2005. An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps. *Journal of Finance* 5: 2255-2281.

Bloom, N., S. Bond, and J. R. Van. 2007. Uncertainty and investment dynamics: Empirical evidence from UK firms. *Review of Economic Studies* 74, 391-415.

Blume, M., F. Lim, and A. MacKinlay. 1998. The declining credit quality of U.S. corporate debt. *Journal of Finance* 53: 1389–1413.

Blundell, R., S. Bond, M. Devereux, and F. Schiantarelli. 1992. Investment and Tobin's Q: Evidence from company panel data. *Journal of Econometrics* 51: 233-257.

Board of Governors of the Federal Reserve System. 2002. Line item instruction for consolidated financial statements for bank holding companies—FR Y-9C.

Bolton, P. and M. Oehmke. 2011. Credit default swaps and the empty creditor problem. *Review of Financial Studies* 24: 2617-55.

Bond, S. and C. Meghir. 1994. Dynamic investment models and the firm's financial policy. *Review of Economic Studies* 61(2): 197-222.

Bond, S., A, Hoeffler, and J. Temple. 2001. GMM estimation of empirical growth models. Discussion Paper No. 01/525. University of Bristol.

Bond, S., J. Elston, J. Mairesse, and B. Mulkay. 2003. Financial factors and investment in Belgium, France, Germany, and the United Kingdom: A comparison using company panel data. *Review of Economics and Statistics* 85:153-165.

Boyle, G. and G. Guthrie. 2003. Investment, uncertainty, and liquidity. *Journal of Finance* 58: 2143-2166.

Brown, C., J. Handley, and J. O'day. 2015. The dividend substitution hypothesis: Australian evidence. *A Journal of Accounting, Finance and Business Studies* 51(1): 37-62.

Bulan, L., N. Subramanian, and L. Tanlu. 2007. On the timing of dividend initiations. *Financial Management* 36 (1): 31-65.

Bushman, R., J. Piotroski, and A. Smith. 2005. Insider trading restrictions and analysts' incentives to follow firms." *Journal of Finance* 60: 35-66.

Calem, P. and J. Rizzo. 1995. Financing constrains and investment: New evidence from hospital industry data. *Journal of Money, Credit, and Banking* 27(4): 1002-1014.

Carpenter, R. and B. Petersen. 2002. Is the growth of small firms constrained by internal finance? *Review of Economics and Statistics* 84: 298-309.

Chahrumilind, C., R. Kall and Y. Wiwattanakantang. 2006. Connected lendings: Thailand before the financial crisis. *Journal of Business* 79: 181–218.

Chaney, P. K., M. Faccio and D. C. Parsley. 2011. The Quality of Accounting Information in Politically Connected Firms. *Journal of Accounting and Economics* 51: 58–76.

Chen, H. J. and S. J. Chen (2012). Investment-cash flow sensitivity cannot be a good measure of financial constraints: Evidence from the time series. *Journal of Financial Economics* 103(2), 393–410.

Chen, R. R., F. Fabozzi, and R. Sverdlove. 2010. Corporate Credit Default Swap Liquidity and Its Implications for Corporate Bond Spreads. *Journal of Fixed Income* 20(2): 31–57.

Chen, S. 2006. The economic impact of corporate capital expenditures: focused firms versus diversified firms. *Journal of Financial and Quantitative Analysis* 41(2): 341-55.

Cleary, S. 1999. The relationship between firm investment and financial status. *Journal of Finance* 54, 673–692.

Cleary, S., P. Povel and M. Raith. 2007. The U-shaped investment curve: Theory and evidence. *Journal of Financial and Quantitative Analysis* 42: 1–40.

Goh, J. C. and L.H. Ederington. 1993. Is a Bond Rating Downgrade Bad News, Good

News, or No News for Stockholders? *Journal of Finance* 48: 2001-2008.

Collin-Dufresne, P., R. Goldstein, and J. Martin. 2001. The determinants of credit spread changes. *Journal of Finance* 56(6): 2177-2207.

Cornell, B. and K. Green. 1991. The investment performance of low-grade bond funds. *Journal of Finance* 46: 29–48.

Dai, Q. and K. Singleton. 2003. Term Structure Dynamics in Theory and Reality. *Review of Financial Studies* 16: 631-678.

Dass, N. and M. Massimo. 2014. The Variety of Maturities Offered by Firms and Institutional Investment in Corporate Bonds. *Review of Financial Studies* 27(7): 2219-2266.

DeAngelo, H., L. DeAngelo, and D. Skinner. 2008. Corporate payout policy. *Foundations and Trends in Finance* 3: 95-287.

DeAngelo, H., L. DeAngelo, and R. Stulz. 2006. Dividend policy and the earned/contributed capital mix: a test of the lifecycle theory. *Journal of Financial Economics* 81: 227-254.

Diamond, D. 1984. Financial intermediation and delegated monitoring. *Review of Economic Studies* 51: 393-414.

Duffee, G. and C. Zhou. 2001. Credit derivatives in banking: useful tools for managing risk. *Journal of Monetary Economics* 48: 25– 54.

Duffie, D. 1999. Credit swap valuation. *Financial Analysts Journal* 55: 73-87.

Duffie, D. and K. J. Singleton. 1999. Modelling term structures of defaultable bonds, *Review of Financial Studies* 12: 687-720.

Easterbrook, F. H. 1984. Two agency-cost explanations of dividends. *American Economic Review* 74(4): 650-59.

Elton, Edwin J., Martin K. Gruber, Deepak Agrawal, and Christopher Mann. 2001. Explaining the rate spread on corporate bonds. *Journal of Finance* 56, 247–277.

Fabozzi, F. 2007. Fixed income analysis. John Wiley & Sons, Inc. Canada. 46-52.

Fama, E. F. and K. R. French. 1993. Common risk factors in the returns on stock and bonds. *Journal of Financial Economics* 33: 3–56.

Fama, E. F. and K. R. French. 2000. Forecasting profitability and earnings. *Journal of Business* 73(2): 161-75.

Fama, E. and R. K. French. 2001. Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay. *Journal of Financial Economics* 60: 3–43.

Fama, E. F. and J. D. MacBeth. 1973. Risk, return, and equilibrium: empirical tests. *Journal of Political Economy* 81: 607-36.

Fazzari, S., R. Hubbard and B. Petersen. 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity: 141–195.

Fenn, G. W. and N. Liang. 2001. Corporate payout policy and managerial stock incentives. *Journal of Financial Economics* 60: 45-72.

Ferris, S., N. Sen, and E. Unlu. 2009. An international analysis of dividend payment behaviour. *Journal of Business Finance & Accounting* 36: 496-522.

Gan, J., M. Lemmon and M. Wang. 2011. Can Firms Build Capital-Market Reputation to Substitute for Poor Investor Protection? Evidence from Dividend Policies. Working paper.

Gatchev, V. A., T. Pulvino, and V. Tarhan. 2010. The interdependent and intertemporal nature of financial decisions: An application to cash flow sensitivities. *Journal of Finance* 65(2): 725–763.

Gilchrist, S. and C. Himmelberg. 1995. Evidence of the role of cash flow in investment. *Journal of Monetary Economics* 36: 541-572.

Greenspan, A. 2004. Economic flexibility, speech to HM Treasury Enterprise Conference, London, U.K.

Greenwood, R. and S.G. Hanson. 2013. Issuer Quality and Corporate Bond Returns. *Review of Financial Studies* 26(6): 1483-1525.

Griffin, J., R. Lowery, and A. Saretto. 2014. Complex Securities and Underwriter Reputation: Do Reputable Underwriters Produce Better Securities? *Review of Financial Studies* 27(10): 2872-2925.

Grullon, G. and R. Michaely. 2002. Dividends, share repurchases and the substitution hypothesis. *Journal of Finance* 57(4): 1649-84.

Grullon, G., R. Michaely, and B. Swaminathan. 2002. Are dividend changes a sign of firm maturity? *Journal of Business* 75(3): 387-424.

Guariglia, A. 2008. Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking and Finance* 32: 1795-1809.

Hand, J., R. Holthausen and R. Leftwich. 1992. The Effect of Bond Rating Agency Announcements on Bond and Stock Prices. *Journal of Finance* 47: 733-752.

Hail, L., A. Tahoun, and C. Wang. 2014. Dividend payouts and information shocks. *Journal of Accounting Research* 52(2): 403-56.

He, J., J. Qian, and P. Strahen. 2012. Are All Ratings Created Equal? The Impact of

Issuer Size on the Pricing of Mortgage-Backed Securities. *Journal of Finance* 67(6): 2097-2137.

He, W. 2012. Agency problems, product market competition and dividend policies in Japan. *Accounting and Finance* 52: 873-901.

Hirtle, B. 2009. Credit derivatives and bank credit supply. J*ournal of Financial Intermediation* 18: 125–50.

Hofstede, G. 1980. Culture's consequences: International differences in work-related values (Sage, Beverly Hills, CA).

Houweling, P., and T. Vorst. 2005. An Empirical Comparison of Default Swap Pricing Models. *Journal of International Money and Finance* 24: 1200-1225.

Huang, J. and M. Huang. 2012. How much of the corporate-Treasury yield spread is due to credit risk? *Review of Asset Pricing Studies* 2(2): 153-202.

Huddart, S. and B. Ke. 2007. Information asymmetry and cross-sectional determinants of insider trading. *Contemporary Accounting Research* 24(1): 195-232.

Hu, H. T. C. and B. S. Black. 2008, Debt, equity, and hybrid decoupling: Governance and systemic risk implications. *European Financial Management* 14: 663–709.

Hull, J., Predescu, M., and White, A. 2004. The relationship between credit default swap spreads, bond yields, and credit rating announcements. *Journal of Banking and Finance* 28: 2789-2811.

Jagannathan, M. and C. Stephens. 2003. Motives for Multiple Open-Market Repurchase Programs. *Financial Management* 32: 71-91.

Jarrow, R. A. and S. Turnbull. 1995. Pricing derivatives on financial securities subject to credit risk. *Journal of Finance* 50: 53–86.

Jayaraman, S. 2012. The effect of enforcement on timely loss recognition: evidence from insider trading laws." *Journal of Accounting and Economics* 53: 77-97.

Jensen, M. C. 1986. Agency costs of free cash flow, corporate finance and take overs. *American Economics Review* 76: 323-339.

Jiraporn, P. and Y. Ning. 2006. Dividend policy, shareholder rights, and corporate governance. *Journal of Applied Finance* 16: 24-36.

Jiraporn, P., J. Kim, and Y. S. Kim. 2011. Dividend payouts and corporate governance quality: an empirical investigation. *The Financial Review* 46: 251-79.

Kahle, K. 2002. When a buyback isn't a buyback: open market repurchases and employee options. *Journal of Financial Economics* 63: 235-61.

Kaplan, S. and L. Zingales (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics* 112, 169–215.

La Porta, R., F. Lopez-De-Silanes, A. Shleifer, and R. Vishny. 2000. Agency problems and dividend policies around the world. *Journal of Finance* 55(1): 1-33.

Lamont, O. 1997. Cash flow and investment: Evidence from internal capital markets. *Journal of Finance* 52(1): 83-109.

Landsman, W., E. Maydew, and J. Thornock. 2012. The Information Content of Annual Earnings Announcements and Mandatory Adoption of IFRS. *Journal of Accounting and Economics* 53: 34-54.

Lang, L. H. P., R. M. Stulz, and R. A. Walkling. A test of the free cash flow hypothesis: the case of bidder returns. *Journal of Financial Economics* 29: 315-35.

Leuz, C. and R. E. Verrecchia. 2000. The economic consequences of increased disclosure. *Journal of Accounting Research* 38 (Supplement): 91-124.

Lewellen, J. and K. Lewellen (2014). Investment and cash flow: New evidence. Tuck School of Business Working Paper (2010-77).

Longstaff, F. A. and E. Schwartz. 1995. A simple approach to valuing risky fixed and floating rate debt. *Journal of Finance* 50: 789–821.

Longstaff, F. A., S. Mithal, and E. Neis. 2005. Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market. *Journal of Finance* 60(5): 2213-2253.

Louis, H. and O. Urcan. 2015. Agency conflicts, dividend payout, and the direct benefits of conservative financial reporting to equity-holders. *Contemporary Accounting Research* 32(2): 455-84.

McCauley, R. 2002. International market implications of declining treasury debt. *Journal of Money, Credit, and Banking* 34: 952–966.

Miller, M. and F. Modigliani. 1961. Dividend policy, growth and the valuation of shares. *Journal of Business* 34(4): 411–33.

Minton, B. A., R. Stulz, and R. Williamson. 2009. How Much Do Banks Use Credit Derivatives to Hedge Loans? *Journal of Financial Services Research* 35: 1–31.

Moyen, N. 2004. Investment-cash flow sensitivities: Constrained versus unconstrained firms. *Journal of Finance* 69: 2061-2092.

Myers, S. C. 1984. The Capital Structure Puzzle. *Journal of Finance* 39: 575-92.

Nissim, D. and A. Ziv. 2001. Dividend changes and future profitability. *Journal of Finance* 56 (6): 2111–33.

Parlour, C. A. and A. Winton. 2013. Laying off credit risk: Loan sales versus credit default swaps. *Journal of Financial Economics* 107: 25-45.

Petersen, M. and R. Rajan. 1994. The benefits of lending relationships: Evidence from small business data. *Journal of Finance* 49(1): 3-37.

Ratner, M. and C. Chiu. 2013. Hedging stock sector risk with credit default swaps. International Review of Financial Analysis 30: 18-25.

Roberts, M. R. and T. M. Whited. 2012. Endogeneity in empirical corporate finance. Simon School Working Paper No. FR 11-29.

Rommens, A., L. Cuyvers, and M. Deloof. 2012. Dividend policies of privately held companies: stand-alone and group companies in Belgium. *European Financial Management* 18(5): 816-35.

Roberts, Michael R., and Toni M. Whited, 2012, Endogeneity in empirical corporate finance, Simon School Working Paper No. FR 11-29.

Roodman, D. 2006. How to do xtabond2: An introduction to difference and system GMM in Stata. Center for Global Development working paper (103).

Rosenbaum, Paul R. and Donald B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70: 41-55.

Rozeff, M. S. 1982. Growth, Beta and Agency Costs as Determinants of Dividend Payout Ratios. *Journal of Financial Research* 5: 249-59.

Saretto, A. and H. Tookes. 2013. Corporate leverage, debt maturity and credit supply: The role of credit default swaps. *Review of Financial Studies* 26: 1190-247.

Skinner, F. and A., Diaz. 2003. An Empirical Study of Credit Default Swaps. *Journal of Fixed Income* 13(1): 28-38.

Shao, L., C. Kwok, and O. Guedhami. 2010. National Culture and Dividend Policy. *Journal of International Business Studies* 41:1391–414.

Stulz, R. M. 2010. Credit default swaps and the credit crisis. *Journal of Economic Perspectives* 24:73–92.

Subrahmanyam, Marti G., Dragon Yongjun Tang, and Sarah Qian Wang. 2014. Does the Tail Wag the Dog? The Effect of Credit Default Swaps on Credit Risk. *Review of Financial Studies* 27(10): 2927-2990.

Subrahmanyam, Marti G., Dragon Yongjun Tang, and Sarah Qian Wang. 2017. Credit default swaps, exacting creditors and corporate liquidity management. *Journal of Financial Economics* 124: 395-414.

Verrecchia, R. 2001. Essays on Disclosure. *Journal of Accounting and Economics* 32: 97-180.

Watts, R. L. 2003. Conservatism in accounting Part I: Explanations and implications. *Accounting Horizons* 17 (3): 207-21.

Whited, T. 1992. Debt, liquidity constraints, and corporate investment: Evidence from panel data. *Journal of Finance* 47(4): 1425-1460.

Wu, M., E. H. C. Kao, and H. Fung. 2008. Impact of dividend-protected employee stock options on payout policies: evidence from Taiwan. *Pacific Economic Review* 13(4): 431-52.

Appendix

Table A.1 Notional principal of credit default swaps during 2004 to 2016 (In trillions of USDs)

	Notional Principal		
Date	Single-name Notional	Multi-name Notional	In Total
12/2004	5.12	1.28	6.40
06/2005	7.31	2.90	10.21
12/2005	10.43	3.48	13.91
06/2006	13.87	6.48	20.35
12/2006	17.88	10.77	28.65
06/2007	24.24	18.34	42.58
12/2007	32.49	25.76	58.25
06/2008	33.41	24	57.41
12/2008	25.74	16.14	41.88
06/2009	24.17	11.93	36.1
12/2009	21.92	10.78	32.7
06/2010	18.5	11.77	30.27
12/2010	18.14	11.75	29.89
06/2011	18.12	14.29	32.41
12/2011	16.87	11.76	28.63
06/2012	15.57	11.36	26.93
12/2012	14.31	10.76	25.07
06/2013	13.14	11.21	24.35
12/2013	11.32	9.7	21.02
06/2014	10.84	8.62	19.46
12/2014	9.041	7.36	16.401
06/2015	8.21	6.39	14.6
12/2015	7.18	5.11	12.29
06/2016	6.62	5.16	11.78

Figure A.1 CDSs notional principal

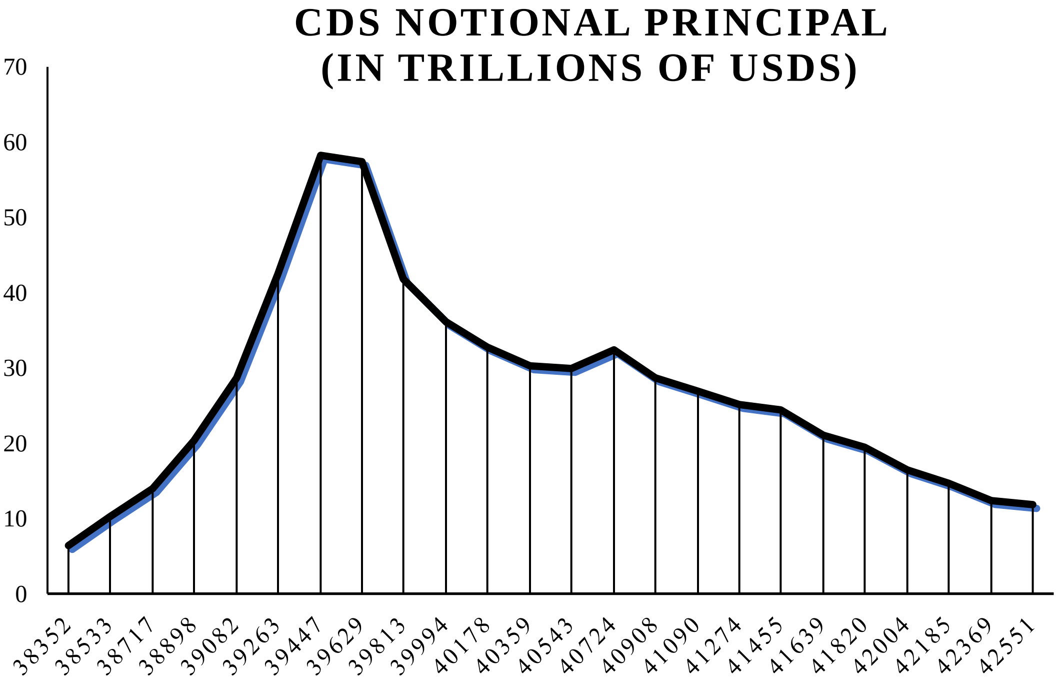


Figure A.2 The diagram for CDS referencing

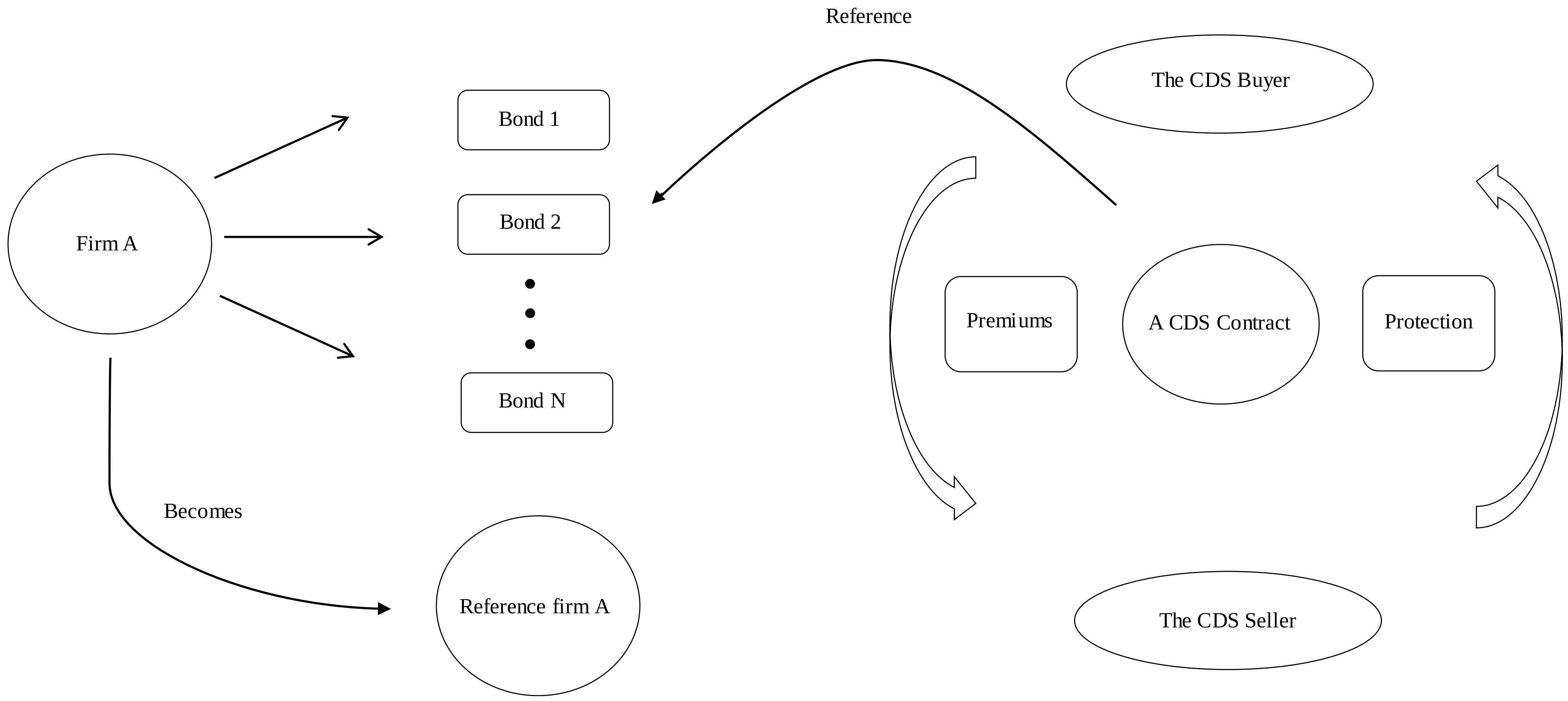


Figure A.3 The number of firms initially referenced by CDSs during 2001 to 2014

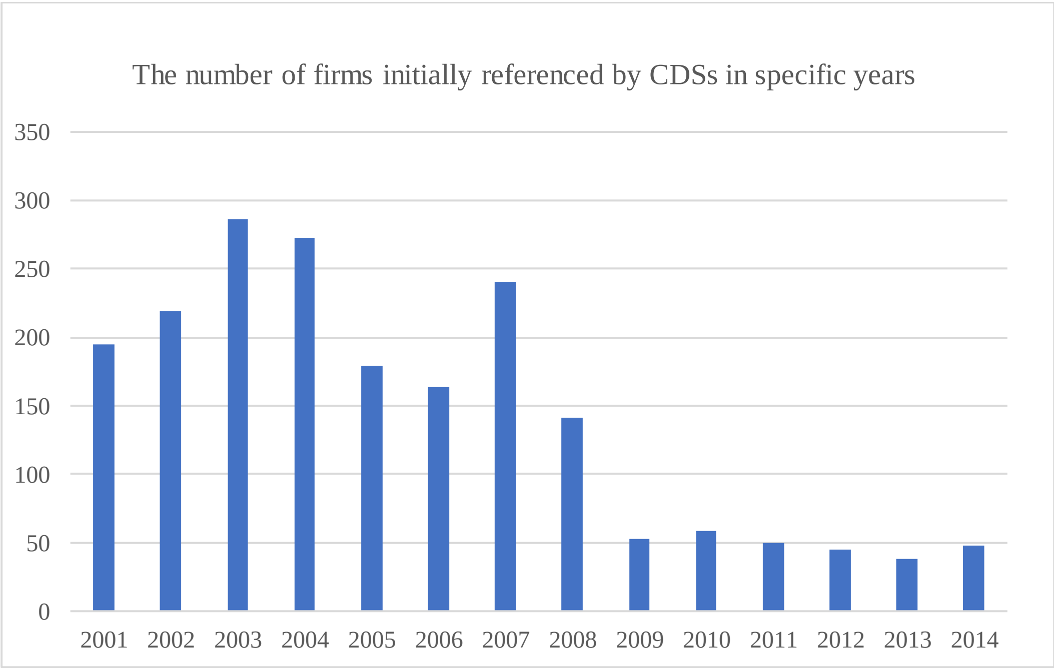


Figure A.4 The number of CDS firms for different sectors

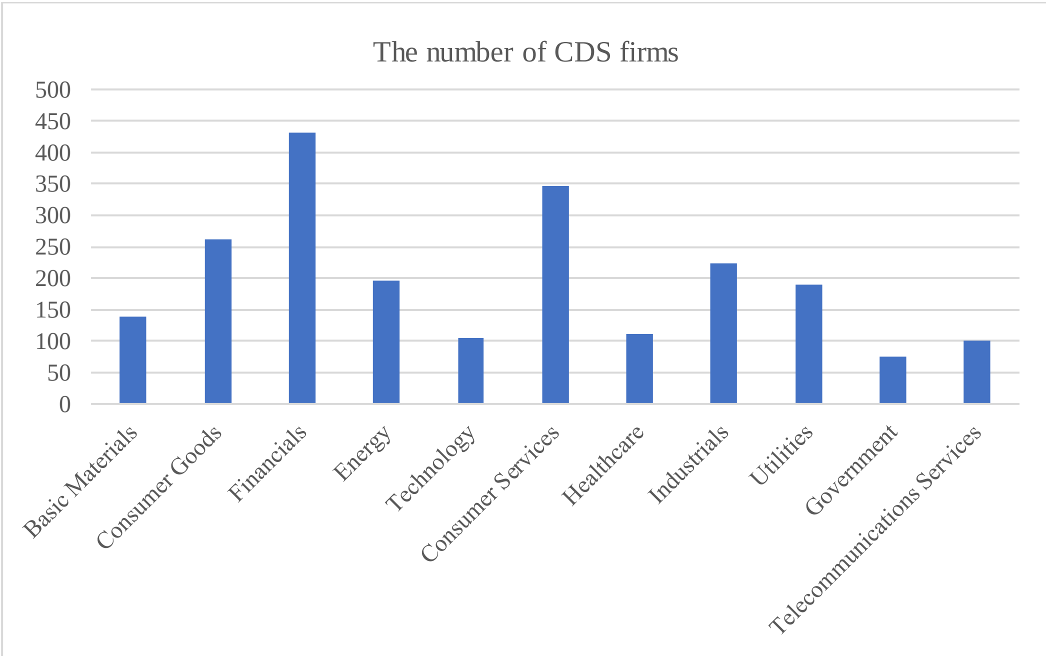


Table A.2 Variable definitions for the chapter 3

Variables	Variable Description	Computation/WRDS mnemonic
Yield Spread$_{i,j,t}$	The difference between returns of a corporate bond j at the issue time t of the firm i and the Treasury with the same maturity as the bond.	treasury_spread
Log Sales$_{i,t-1}$	Natural log of sales of the firm i in the quarter just before issuing t-1.	Log(SALEQ)
Profitability$_{i,t-1}$	Net income over sales of the firm i in the quarter just before issuing t-1.	NIQ/SALEQ
Leverage$_{i,t-1}$	Total liability over total assets of the firm i in the quarter just before issuing t-1.	LTQ/ATQ
Rating$_{i,t-1}$	The firm's credit rating in the quarter just before issuing t-1.	SPLTICRM
Log Amount$_{i,t}$	Natural log of the bond's issue amount	Log(offering_amt)
Log Maturity$_{i,t}$	Natural log of the bond's maturity	Log(maturity-offering_date)
Enhancement$_{i,t}$	The dummy variable equals 1 for bonds with enhancement terms, 0 otherwise.	enhancement
Convertible$_{i,t}$	The dummy variable equals 1 for convertible bonds, 0 otherwise.	convertible
Redeemable$_{i,t}$	The dummy variable equals 1 for redeemable bonds, 0 otherwise.	redeemable
Puttable$_{i,t}$	The dummy variable equals 1 for puttable bonds, 0 otherwise.	putable

Table A.2 Variable definitions for the chapter 3 (continued)

CDS $Start_{i,t}$	The dummy variable equals 1 for bonds issued by a reference firm i after the beginning date of the firm's CDS trading, 0 otherwise.	DATE
CDS $Company_{i,t}$	The dummy variable equals 1 for CDS reference firms, 0 otherwise.	REDCODE
$Good_{i,t-1}$&CDS $Start_{i,t}$	The dummy variable equals 1 if a bond is issued after CDS trading and during good credit periods, 0 otherwise.	/
No $Good_{i,t-1}$&No CDS $Start_{i,t}$	The dummy equals 1 for a bond is issued without CDS trading and during no good credit periods, 0 otherwise.	/
No $Good_{i,t-1}$&CDS $Start_{i,t}$	The dummy equals 1 for a bond is issued after CDS trading and during no good credit periods, 0 otherwise.	/
$Bad_{i,t-1}$&CDS $Start_{i,t}$	The dummy variable equals 1 if a bond is issued after CDS trading and during bad credit periods, 0 otherwise.	/
No $Bad_{i,t-1}$&No CDS $Start_{i,t}$	The dummy equals 1 for a bond is issued without CDS trading and during no bad credit periods, 0 otherwise.	/
No $Bad_{i,t-1}$&CDS $Start_{i,t}$	The dummy equals 1 for a bond is issued after CDS trading and during no bad credit periods, 0 otherwise.	/

Table A.2 Variable definitions for the chapter 3 (continued)

Log Assets$_{i,t-1}$	Natural log of total assets of the firm i in the term t-1.	Log(ATQ)
ROA$_{i,t-1}$	Income over total assets of the firm i in the term t-1.	OIADPQ/ATQ
PPENT$_{i,t-1}$	Property, plant and equipment over total assets of the firm i in the term t-1.	PPENTQ/ATQ
RE$_{i,t-1}$	Retained earnings over total assets of the firm i in the term t-1.	REQ/ATQ
Rated$_{i,t-1}$	The dummy variable equals 1 for rated company, 0 otherwise.	/
IG$_{i,t-1}$	The dummy variable equals 1 for investment grade company, 0 otherwise.	/

For variables defined by information of other variables, we use the symbol "/" in the column of Computation/WRDS mnemonic.

Table A.3 Variable definitions for the chapter 4

Variables	Variable Description	Computation/WRDS mnemonic
$I_{it}/TA_{i,t-1}$	Defined as the fixed investment, I_{it}, of the firm divided by its total assets in last period, TA_{it-1}.	CAPX/Lag of AT
$I_{i,t-1}/TA_{i,t-2}$	One lag of the relative value of investment.	Lag of (CAPX/Lag of AT)
$CF_{i,t}/TA_{i,t-1}$	The ratio of the firm's cash flow, CF_{it}, to its last period total assets, TA_{it-1}.	OANCF/Lag of AT
$Q_{i,t-1}$	Equity market value to book value of asset in the last period.	PRCC_F*CSHO/BKVLPS*CSHO
CDS $Start_{it}$	The dummy variable equals 0 for investments occurring before the onset of CDS trading, 1 otherwise.	DATE
$CF_{it}/TA_{it-1}\times$CDS $Start_{it}$	The interaction of investment-cash flow sensitivity and CDS availability indicator.	/

For variables defined by information of other variables, we use the symbol "/" in the column of Computation/WRDS mnemonic.

Table A.4 Variable definitions for the chapter 5

Variables	Variable Description	Computation/WRDS mnemonic
Dividend Payments$_{i,t}$	The dummy variable equals 1 if the firm i pays a dividend in the time t, 0 otherwise.	DVC
Dividend Increases$_{i,t}$	The dummy variable that is given value 1 if a firm's dividend payment this year is more than in the previous year.	
Dividend Continuities$_{i,t}$	The dummy variable equals 1 for firms continuously pay dividends in year t-1 and year t, 0 otherwise.	
Dividend Decreases$_{i,t}$	The dummy variable equals 1 when firms pay lower dividend than they did in the previous year, 0 otherwise.	
Firm Size$_{i,t-1}$	Natural log of the firm's total assets.	Log(AT)
Leverage$_{i,t}$	Total liability over total assets.	LT/AT
ROA$_{i,t}$	Operating income over total assets.	OIBDP/AT
Growth$_{i,t}$	One-year sales growth.	Log(SALE) - Log(Lag of SALE)
Q$_{i,t}$	Equity market value to book value of assets.	PRCC_F*CSHO/BKVLPS*CSHO
Cash Holding$_{i,t}$	Cash and short-term investment over total assets.	CHE/AT
RE$_{i,t}$	Retained earnings over common equity.	RE/CEQ
CDS Start$_{i,t}$	The dummy equals 1 in the onset year of CDS trading and years after, 0 otherwise.	DATE

Table A.4 Variable definitions for the chapter 5 (continued)

$DIV_{i,t}/Ta_{i,t}$	Dividend amounts over total assets.	DVC/AT
$DIV_{i,t}/Mv_{i,t}$	Dividend amounts over market value of equity.	DVC/PRCC_F*CSHO
$DIV_{i,t}/SHO_{i,t}$	Dividend amounts over common shares outstanding.	DVC/CSHO
$DIV_{i,t}/NI_{i,t}$	Dividend amounts over net income.	DVC/NI
CDS $Firm_{i,t}$	The dummy variable equals 1 for CDS reference firms, 0 otherwise.	REDCODE
$(I_{i,t} - I_{i,t-1})/BVE_{i,t-2}$	The variable measures changes of firms' earnings.	(IB-Lag of IB)/Twice Lag of CEQ
$ROE_{i,t-1}$	Operating income over book value of equity.	IB/CEQ
$(I_{i,t-1} - I_{i,t-2})/BVE_{i,t-2}$	Earnings changes in the term t-1 over book value of equity in the term t-2.	(Lag of IB- Twice Lag of IB)/Twice Lag of CEQ
Dividend $Payments_{i,t-1}$ × CDS $Start_{i,t-1}$	The interaction of the dummy Dividend Payments and the CDS availability indicator.	/
Dividend $Increases_{i,t-1}$ × CDS $Start_{i,t-1}$	The interaction of the dummy Dividend Increases and the CDS availability indicator.	/
Dividend $Continuities_{i,t-1}$ × CDS $Start_{i,t-1}$	The interaction of the dummy Dividend Continuities and the CDS availability indicator.	/
Dividend $Decreases_{i,t-1}$ × CDS $Start_{i,t-1}$	The interaction of the dummy Dividend Decreases and the CDS availability indicator.	/

Table A.4 Variable definitions for the chapter 5 (continued)

Three days abnormal stock $\text{returns}_{i,t}$	Calculated as the sum of raw stock returns of firm i on days t-1, t and t+1 around dividend announcement day t minus the sum of market index returns on days t-1, t and t+1.	The change rate of prc - the change of sprtrn
Dividend $\text{Changes}_{i,t}$	Computed as dividend amounts in the quarter t minus that in the t-1.	divamount - Lag of divamount
Earning $\text{Changes}_{i,t}$	Operating income over common equity in the quarter t minus that in the quarter t-1.	OIBDPQ/CEQQ - Lag of (OIBDPQ/CEQQ)
Dividend $\text{Changes}_{i,t}$ × CDS $\text{Start}_{i,t}$	The interaction of Dividend changes and CDS availability indicator.	/
Firm $\text{Sales}_{i,t-1}$	Natural log of the firm's sales.	Log(SALE)
$\text{WCAP}_{i,t-1}$	Working capital over total assets.	WCAP/AT
$\text{IB}_{i,t-1}$	Income before extraordinary items over total assets.	IB/AT
$\text{EBIT}_{i,t-1}$	Earnings before interest and tax over total assets.	EBIT/AT

For variables defined by information of other variables, we use the symbol "/" in the column of Computation/WRDS mnemonic.

Dividend Paymentsi,t, Dividend Increasesi,t, Dividend Continuitiesi,t, Dividend Decreasesi,t are defined by the information of DVC in WRDS.

Figure A.5 The average yield spread for the non-matched sample based on different groups

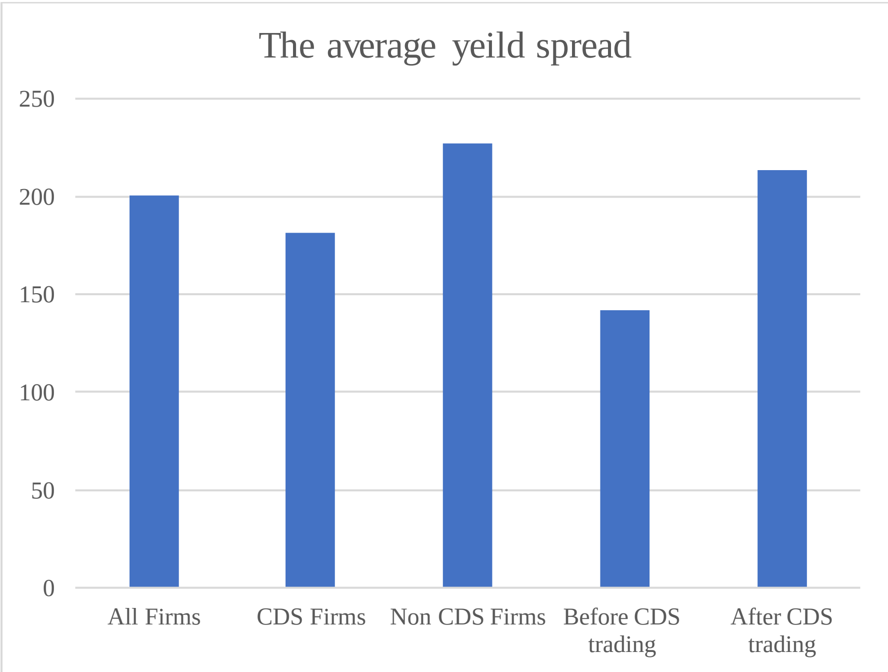


Figure A.6 The average yield spread for the non-matched sample based on specific conditions

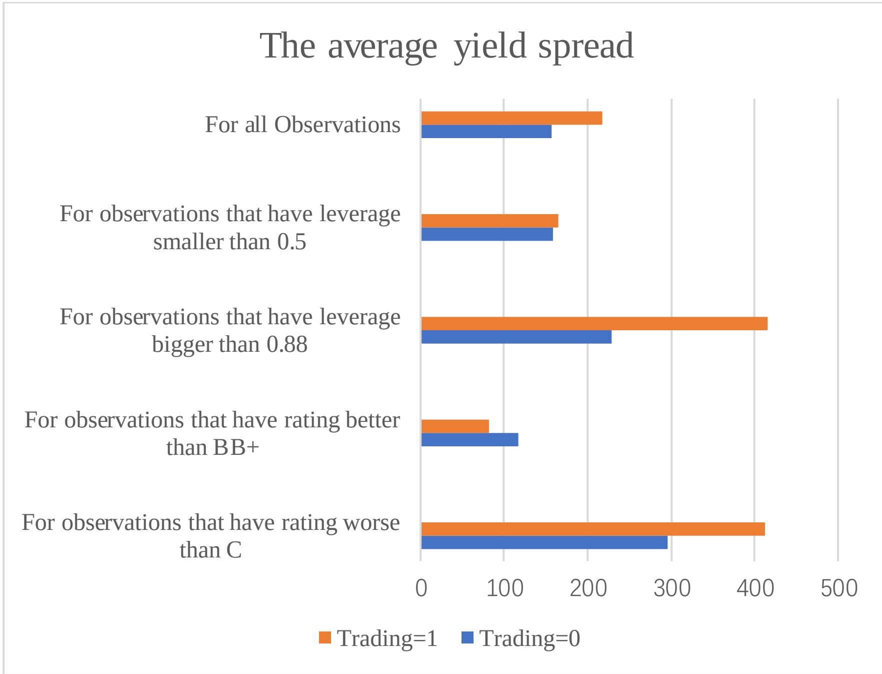


Figure A.7 The average yield spread for the p score matched sample based on different groups

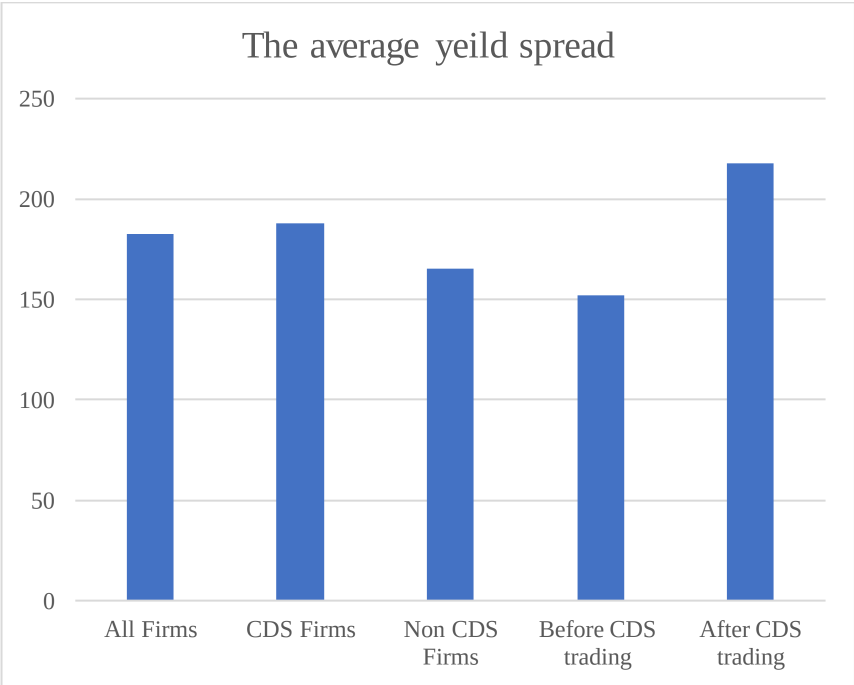


Figure A.8 The average yield spread for the p score matched sample based on specific conditions

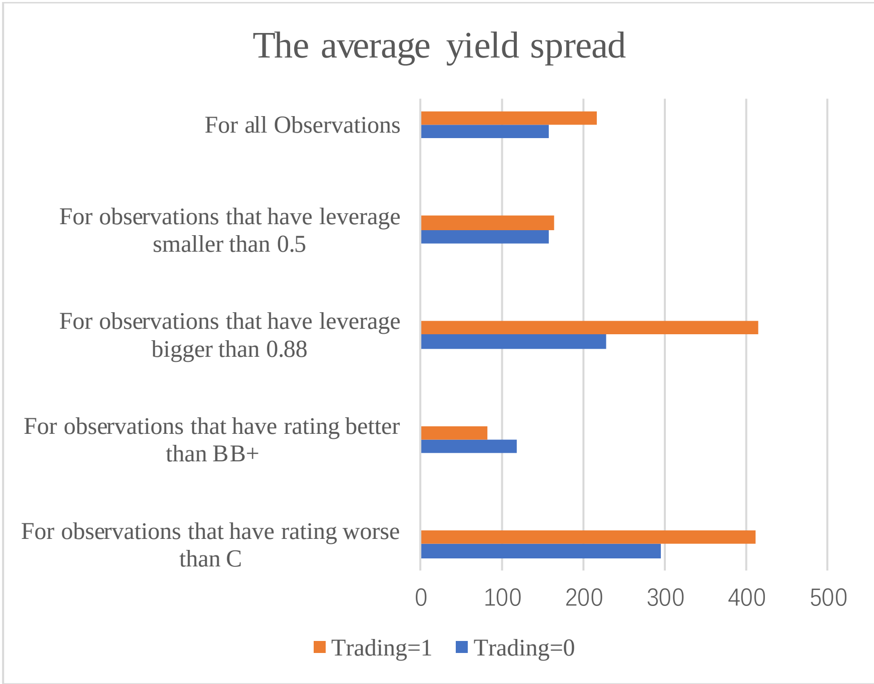


Figure A.9 The ratio of all firms with different ratings

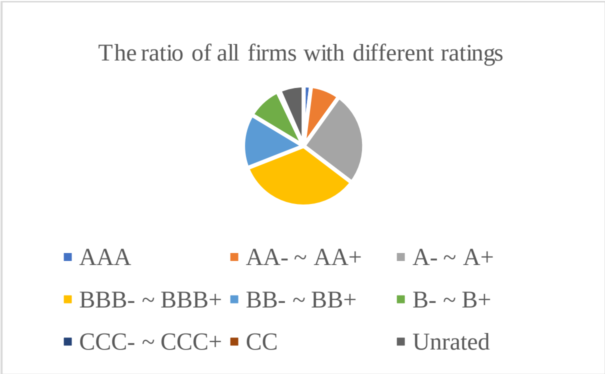


Figure A.10 The ratio of CDS firms with different ratings

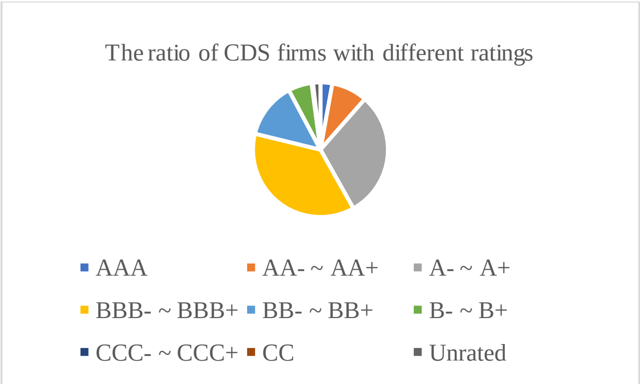


Figure A.11 The ratio of non-CDS firms with different ratings

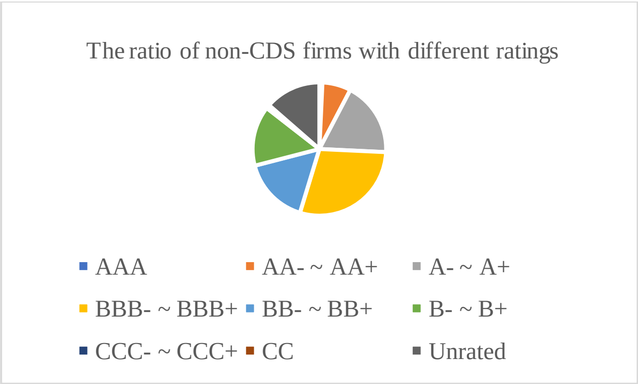


Table A.5 Does CDS effect vary? Including cash flow as control variable

VARIABLES	(1) Spread	(2) Spread	(3) Spread
Log Sales	-23.93***	-8.017**	-33.97***
	(2.768)	(3.386)	(3.044)
Profitability	-187.0***	-103.3***	-165.4***
	(20.01)	(11.66)	(20.05)
Leverage	67.91***	102.2***	85.12***
	(18.36)	(14.55)	(18.55)
Cash Flows	-123.3***	-103.4***	-207.6***
	(45.88)	(38.25)	(48.97)
Rating	28.44***	7.241***	19.13***
	(2.192)	(1.661)	(2.062)
Log Amount	16.99***	13.84***	9.040***
	(3.290)	(2.451)	(2.775)
Log Maturity	-5.015	16.57***	4.925*
	(3.290)	(3.108)	(3.491)
Enhancement	8.101	-24.45***	-15.79
	(9.493)	(6.283)	(9.010)
Convertible	-182.1***	-155.2***	-166.5***
	(13.98)	(16.36)	(15.80)
Redeemable	-3.610	-4.857	-17.87***
	(5.629)	(4.251)	(5.474)
Puttable	-19.10	-20.03*	-13.87
	(11.87)	(12.14)	(11.66)
CDS Start	-242.5***	-262.2***	-248.1***
	(28.46)	(13.85)	(23.06)
CDS Start × Rating	56.45***	62.09***	52.74***
	(6.954)	(3.018)	(5.706)
CDS Company	-21.99		-8.221
	(27.586)		(7.073)
Constant	-19.39	-39.20	-230.8***
	(41.86)	(78.23)	(50.47)
Observations	5,651	5,651	5,651
R-squared	0.586	0.841	0.693

Column (1) is estimated with robust standard error and clustered by company. Column (2) is estimated with robust standard error and firm-fixed effects. Column (3) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS start: dummy variable that is equal to one for bonds after the beginning date of the firm's CDS trading. Rating is the number linked to the firm's credit rating. The conversion is AAA = 1, AAA- = 1.33,…, C- = 9. Log Amount: natural log of the bond's issue amount. Log Maturity: natural log of the bond's maturity. Enhancement: bonds with some enhancement terms. Convertible: convertible bond. Redeemable: redeemable bonds. Puttable: bonds with put option. See table 1 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table A.6 P score matched sample using time of issue as the extra covariate for matching

	The Yield Spread					
	Negative CDS Effect			Positive CDS Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
Good & CDS Start	-27.06**	-49.07***	-31.91***			
	(10.79)	(7.957)	(8.874)			
No Good & No CDS Start	-2.904	-4.888	-6.605			
	(9.491)	(7.102)	(9.112)			
No Good & CDS Start	27.89***	22.19***	16.81			
	(12.35)	(8.620)	(11.42)			
Bad & CDS Start				92.11***	96.13***	84.21***
				(17.29)	(8.612)	(15.86)
No Bad & No CDS Start				-106.1***	-33.64***	-76.24***
				(13.62)	(9.021)	(13.80)
No Bad & CDS Start				-110.8***	-55.29***	-90.95***
				(15.38)	(9.568)	(15.27)
CDS Company	-6.292		-2.712	-10.09		-14.50
	(16.97)		(15.92)	(15.90)		(17.57)
Constant	-101.3*	7.263	124.2	132.1***	105.1	273.1***
	(51.79)	(99.46)	(78.88)	(49.86)	(97.26)	(74.79)
Observations	4,337	4,337	4,337	4,337	4,337	4,337
R-squared	0.585	0.763	0.683	0.645	0.776	0.714

Column (1), (4) are estimated with robust standard error and clustered by company. Column (2), (5) are estimated with robust standard error and firm-fixed effects. Column (3), (6) controls industry-fixed effects and clusters standard error at the firm level. All three columns are estimated with controlling time-fixed effects. CDS company: dummy variable that equals to one for companies referenced by CDS. Good & CDS start: dummy variable that equals one for bonds issued after CDS trading and during good credit periods. No Good & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no good credit periods. No Good &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no good credit periods. Bad & CDS start: dummy variable that equals one for bonds issued after CDS trading and during bad credit periods. No Bad & No CDS start: dummy variable that equals one for bonds issued without CDS trading and during no bad credit periods. No Bad &CDS start: dummy variable that equals one for bonds issued after CDS trading and during no bad credit periods. See table 1 and 2 for definitions of remaining variables. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Figure A.12 The average investment rate for the broad/manufacturing sample before CDS trading and after CDS trading

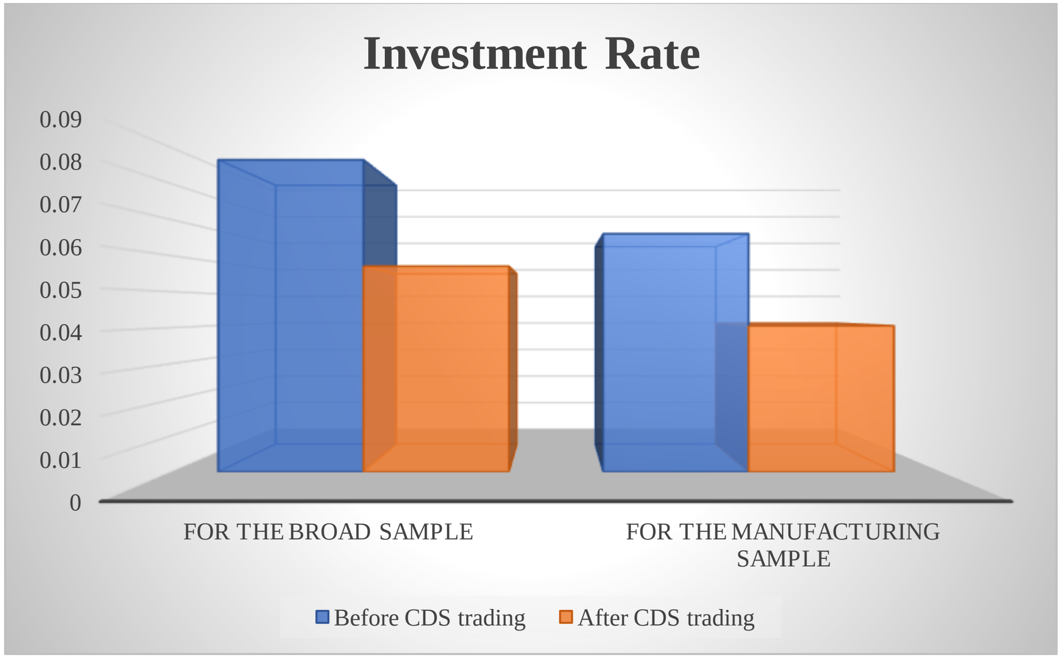


Table A.7 GMM estimation including Sales Growth for the chapter 4

Dependent variable: I_{it}/TA_{it-1}	Broad Sample		Manufacturing Industry	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.293***	0.000456	0.373***	0.143
	（0.099）	(0.0721)	(0.0425)	(0.105)
Q_{it-1}	0.000219	-0.0011	0.0000516	-0.000324
	（0.00053）	(0.00081)	(0.0002)	(0.000368)
CF_{it}/TA_{it-1}	0.212***	0.207***	0.143***	0.0587
	（0.0712）	(0.0768)	(0.0249)	(0.0973)
Sales $Growth_{it-1}$	0.0607***	0.0296*	0.0173**	0.0236**
	(0.019)	(0.0168)	(0.00793)	(0.012)
CDS $Start_{it}$	-0.00594***	-0.0316**	0.00272	-0.0206**
	(0.0022)	(0.0152)	(0.00234)	(0.00808)
CF_{it}/TA_{it-1}×CDS $Start_{it}$		0.254*		0.206**
		(0.144)		(0.0823)
Observations	11683	11683	5430	5430
M1(p)	0.000	0.039	0.000	0.015
M2(p)	0.729	0.151	0.101	0.477
Hansen(p)	0.146	0.111	1	0.604

Table A.5 shows results of equation 1 and 2 for the broad sample and the manufacturing industry. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. Sales Growth $_{it-1}$ is one year sales growth. CDS $Start_{it}$ equals 1 for investments occurring after CDS trading, 0 otherwise. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table A.8 Statistics comparison of average leverage/cash holding before and after CDS trading for high and low liquidity firms

Panel A: Broad sample using cash flow as the liquidity proxy

	High Liquidity			Low Liquidity		
	CDS Start=0	CDS Start=1	Increasing Ratio	CDS Start=0	CDS Start=1	Increasing Ratio
Leverage	0.55436	0.66827	20.54801934	0.66526	0.71602	7.63009951
Observation	1,858	1,746	3,604	1,919	1,515	3,434
Cash Holding	0.13401	0.15042	12.24535482	0.05714	0.07681	34.42422121
Observation	1,498	1,450	2,948	1,569	1,247	2,816

Panel B: Broad sample using coverage ratio as the liquidity proxy

	High Liquidity			Low Liquidity		
	CDS Start=0	CDS Start=1	Increasing Ratio	CDS Start=0	CDS Start=1	Increasing Ratio
Leverage	0.47073	0.57672	22.51609203	0.73166	0.79073	8.073422081
Observation	1,499	1,447	2,946	1,569	1,247	2,816
Cash Holding	0.11174	0.13072	16.98586003	0.05979	0.09434	57.78558287
Observation	1,438	1,509	2,947	1,488	1,287	2,775

Panel C: Manufacturing sample using cash flow as the liquidity proxy

	High Liquidity			Low Liquidity		
	CDS Start=0	CDS Start=1	Increasing Ratio	CDS Start=0	CDS Start=1	Increasing Ratio
Leverage	0.51667	0.59158	14.49861614	0.65656	0.71389	8.731875228
Observation	813	824	1,637	907	711	1,618
Cash Holding	0.12364	0.13766	11.33937237	0.09513	0.12123	27.43614002
Observation	813	824	1,637	908	711	1,619

Panel D: Manufacturing sample using coverage ratio as the liquidity proxy

	High Liquidity			Low Liquidity		
	CDS Start=0	CDS Start=1	Increasing Ratio	CDS Start=0	CDS Start=1	Increasing Ratio
Leverage	0.46243	0.55002	18.94124516	0.71688	0.75747	5.662035487
Observation	776	767	1,543	828	702	1,530
Cash Holding	0.14595	0.17755	21.65125043	0.04885	0.084181	72.32548618
Observation	776	767	1,543	1,488	1,287	2,775

Table A.9 Robustness check for chapter 4 using CDS_{it-1} as the interested variable

Dependent variable: I_{it}/TA_{it-1}	Broad Sample		Manufacturing Sample	
	(1)	(2)	(3)	(4)
I_{it-1}/TA_{it-2}	0.344***	0.0385	0.129***	0.254*
	(0.0934)	(0.104)	(0.0507)	(0.128)
Q_{it-1}	0.000696	-0.00227	0.000644	-0.000157
	(0.000645)	(0.00160)	(0.000715)	(0.000446)
CF_{it}/TA_{it-1}	0.307***	0.323***	0.237***	0.00656
	(0.0956)	(0.104)	(0.0638)	(0.102)
CDS $Start_{it-1}$	-0.01765**	-0.0484**	-0.00298*	-0.0158**
	(0.00738)	(0.0205)	(0.00173)	(0.00798)
$CF_{it}/TA_{it-1} \times$ CDS $Start_{it-1}$		0.405**		0.116**
		(0.198)		(0.059)
Observations	11,683	11,683	5,430	5,430
M1(p)	0.000	0.026	0.044	0.006
M2(p)	0.624	0.215	0.288	0.363
Hansen(p)	0.181	0.781	0.171	0.168

Table 4.2 shows results of equation 1 and 2 for the broad sample and the manufacturing industry. I_{it}/TA_{it-1} is the relative value of investment. I_{it-1}/TA_{it-2} is one lag of the relative value of investment. Q_{it-1} is the ratio of equity market value last term to book value of asset last term. CF_{it} /TA_{it-1} is the ratio of the firm's cash flow this term to its total assets last term. CDS $Start_{it}$ equals 0 for investments occurring before CDS trading, 1 otherwise. Observations are the numbers of observations. M1 and M2 are tests for first-order and second order serial correlation in the first-differenced errors. Hansen is the result of Hansen test. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Figure A.13 The probability of payments for CDS firms and matched non-CDS firms

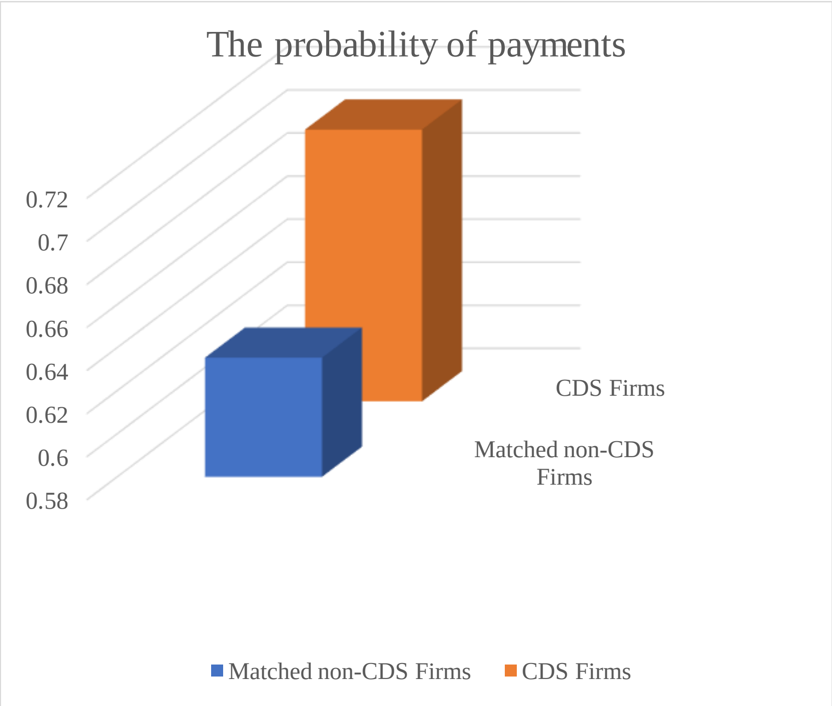


Figure A.14 The probability of payments for CDS Start=0 and CDS Start=1

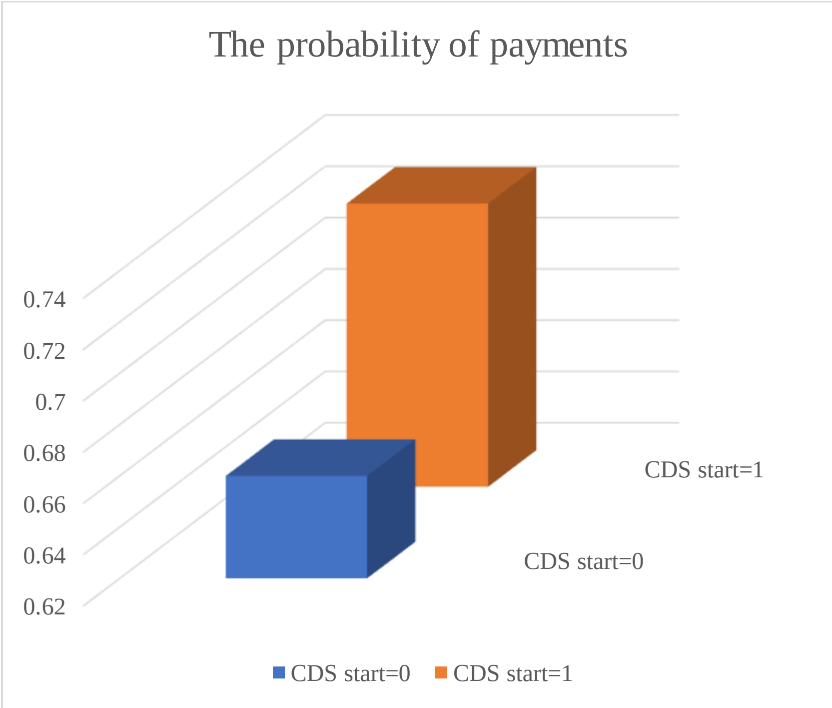


Figure A.15 The probability of increases for
CDS firms and matched non-CDS firms

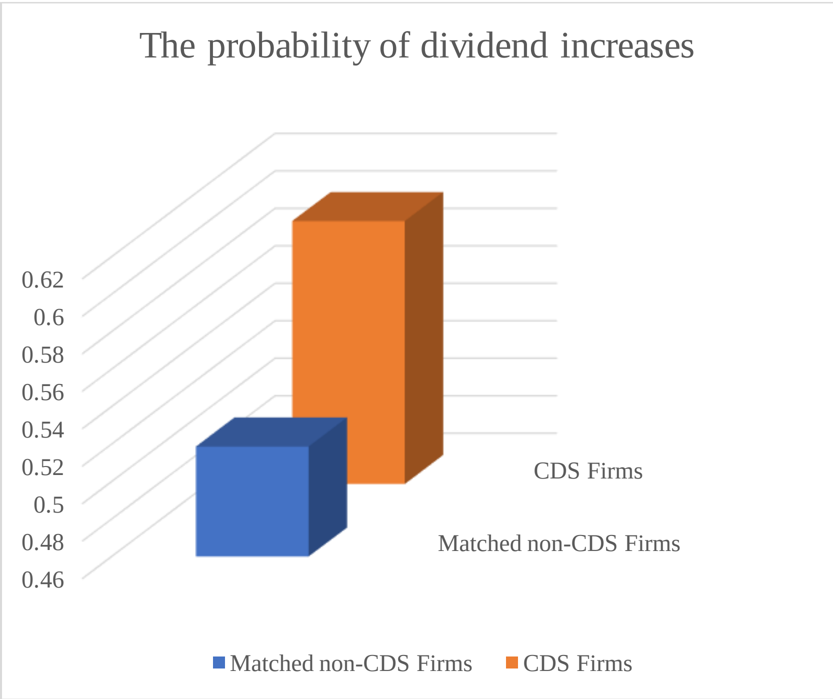


Figure A.16 The probability of increases for
CDS Start=0 and CDS Start=1

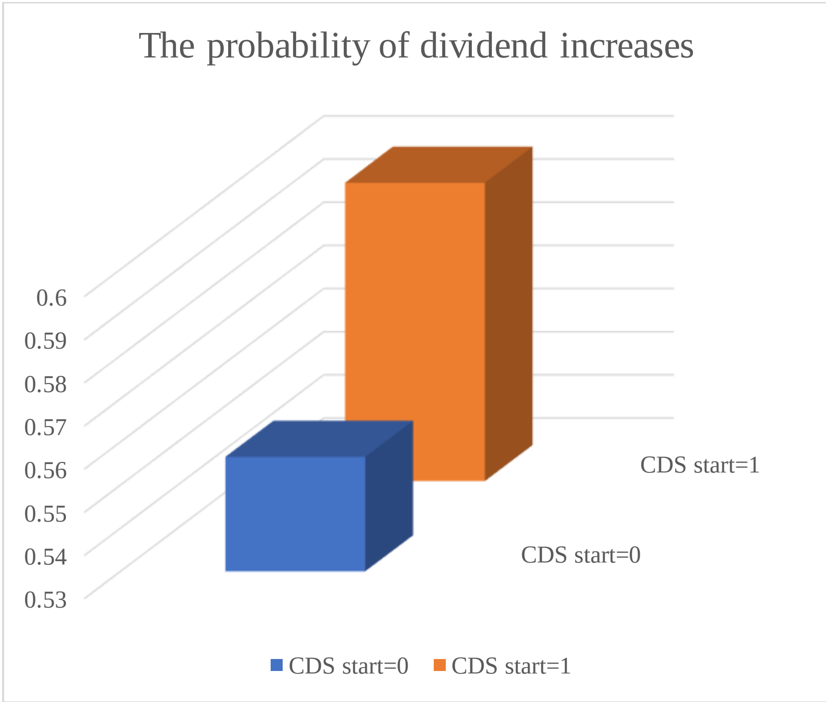


Figure A.17 The probability of continuities for CDS firms and matched non-CDS firms

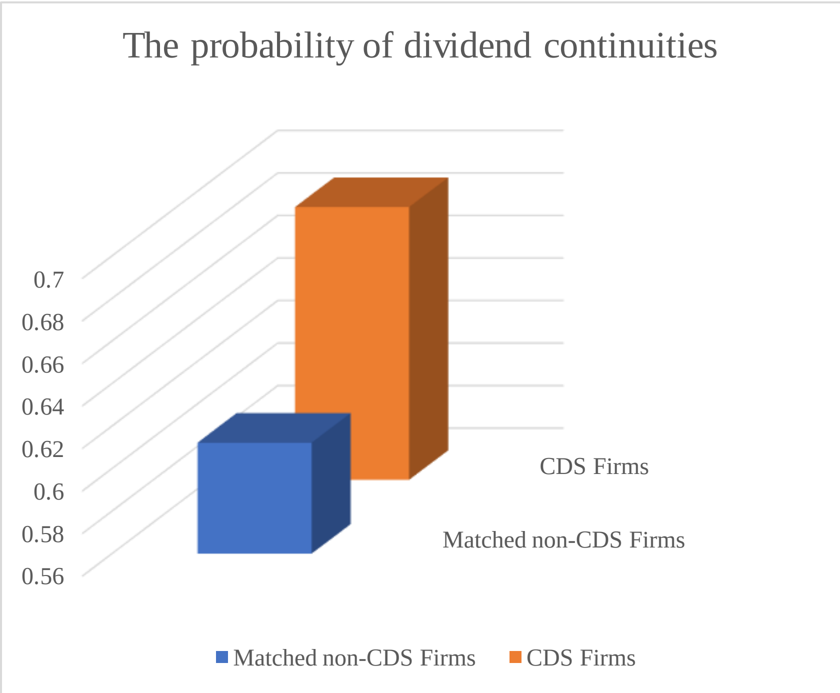


Figure A.18 The probability of continuities for CDS Start=0 and CDS Start=1

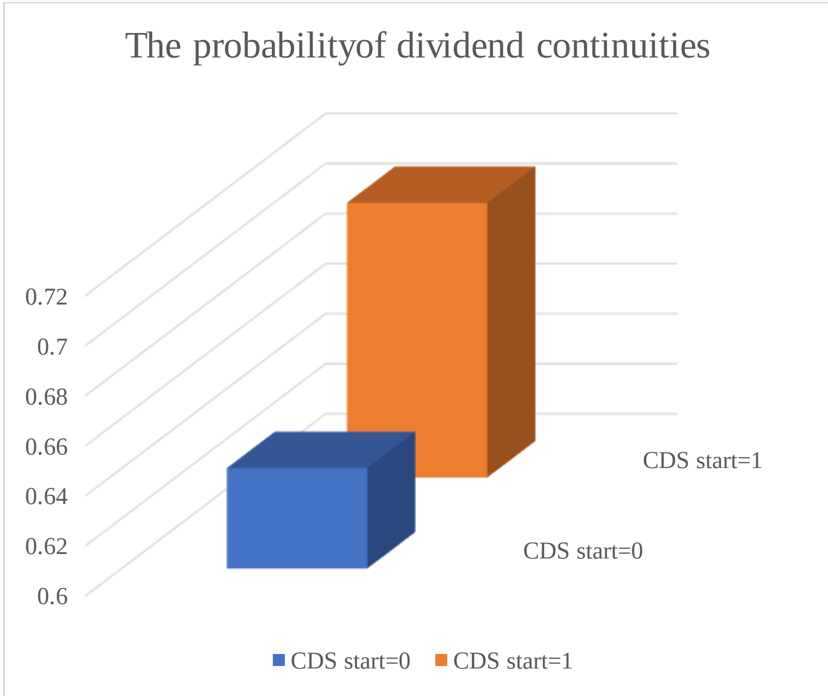


Figure A.19 The probability of decreases for CDS firms and matched non-CDS firms

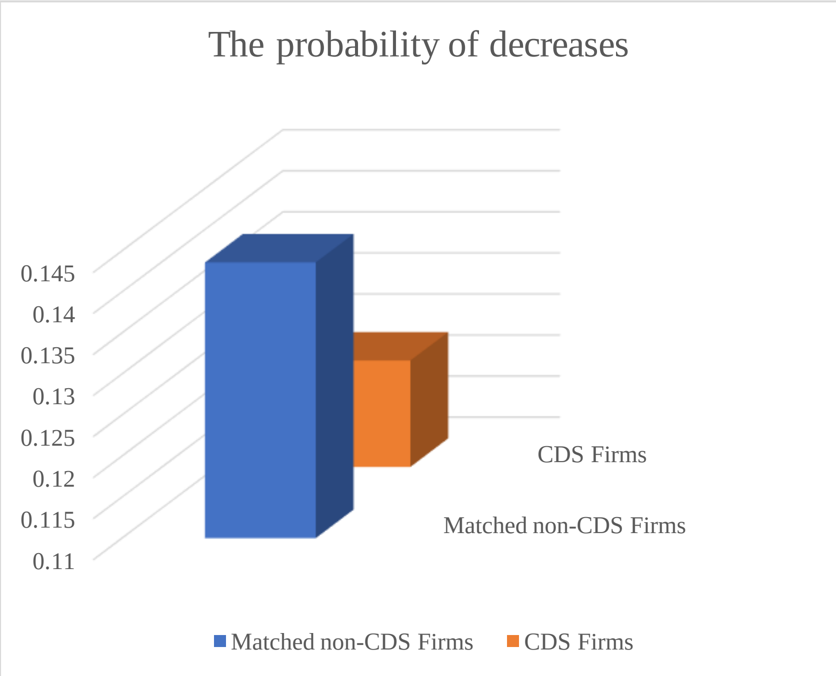


Figure A.20 The probability of decreases for CDS Start=0 and CDS Start=1

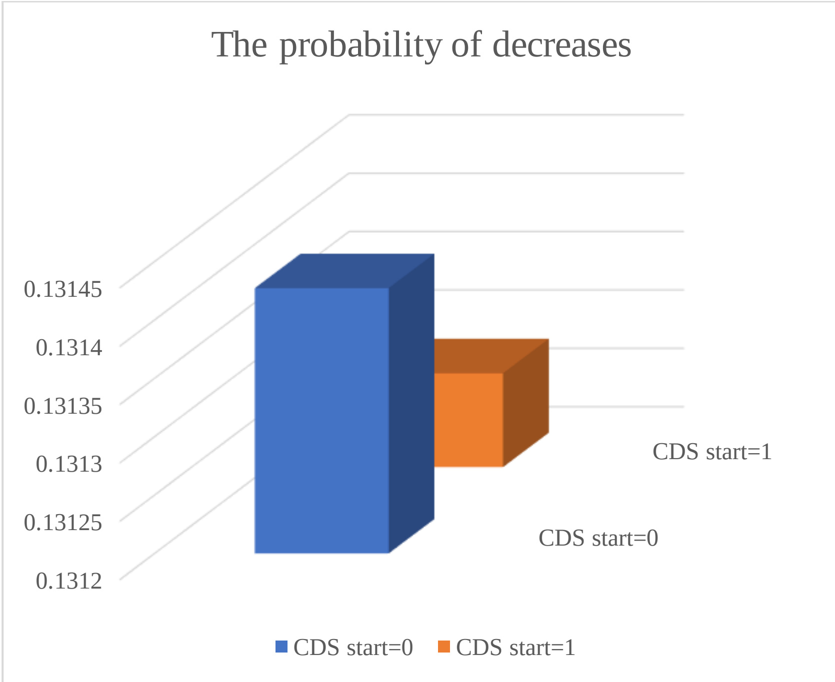


Table A.10 Robustness check for chapter 5 adding firm age, credit rating and coverage ratio as covariates for matching

Dependent variable:	Dividend Payments	Dividend Increases	Dividend Continuities	Dividend Decreases
	(1)	(2)	(3)	(4)
Firm Size	1.251***	0.728***	1.340***	-0.0245
	(0.0585)	(0.0389)	(0.0604)	(0.0418)
Leverage	-2.360***	-2.551***	-2.163***	1.696***
	(0.210)	(0.171)	(0.215)	(0.183)
ROA	7.029***	7.971***	5.578***	-3.528***
	(0.544)	(0.433)	(0.540)	(0.416)
Tobin's Q	0.0207**	0.0118**	0.0231**	-0.0117*
	(0.00823)	(0.00590)	(0.00843)	(0.00605)
Growth	-1.072***	0.769***	-1.103***	-1.752***
	(0.139)	(0.101)	(0.141)	(0.117)
Cash Holding	-0.408	-0.577*	-1.032**	-0.405
	(0.411)	(0.318)	(0.427)	(0.361)
RE	0.0586***	0.0466***	0.0623***	-0.00494
	(0.0121)	(0.00998)	(0.0125)	(0.00893)
CDS Start	0.436***	0.144***	0.548***	0.0150
	(0.114)	(0.0672)	(0.115)	(0.0859)
Firm Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	9,161	17,697	8,836	17,145

This table shows the impact of CDSs on firms' dividend policies. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respectively.

Table A.11 Robust test for chapter 5 using fixed time effects and clustered by firm

Dependent variable:	Dividend Payments	Dividend Increases	Dividend Continuities	Dividend Decreases
	(1)	(2)	(3)	(4)
Firm Size	0.663***	0.447***	0.657***	0.116***
	(0.0458)	(0.0304)	(0.0454)	(0.0240)
Leverage	-1.814***	-1.613***	-1.833***	0.326*
	(0.292)	(0.227)	(0.293)	(0.182)
ROA	5.377***	5.451***	5.060***	-0.493
	(0.740)	(0.562)	(0.722)	(0.372)
Tobin's Q	0.0245**	0.0231***	0.0261***	-0.0158**
	(0.00987)	(0.00734)	(0.00974)	(0.00734)
Growth	-1.791***	-0.304***	-1.857***	-2.049***
	(0.124)	(0.100)	(0.127)	(0.130)
Cash Holding	-5.099***	-4.596***	-5.364***	-0.537*
	(0.500)	(0.408)	(0.513)	(0.301)
RE	0.0837***	0.0675***	0.0873***	0.0185*
	(0.0146)	(0.0111)	(0.0154)	(0.0102)
CDS Quotes Number	0.496***	0.390***	0.547***	0.0357
	(0.122)	(0.0923)	(0.121)	(0.100)
Cluster	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	21,569	21,569	21,569	21,569

This table shows the impact of CDSs on firms' dividend policies. Dividend payments equals to 1, if the firm pays a dividend, 0 otherwise. Dividend increases gets value 1 if a firm's dividend payment this year is more than that in the last year. For firms continue to pay dividends in two years, dividend continuities gets 1, 0 otherwise. Dividend decreases equals to 1 when firms pay lower dividend than they did in the previous year. Log (Total assets): natural log of the firm's total assets. Leverage: total liability over total assets. Return on assets: operating income over total assets. Tobin's Q: market value to book value. Growth: one-year sales growth. Cash: cash and short-term investment over total assets. RE: retained earnings over common equity. CDS Start equals to 1 in the onset year of CDS trading and years after, 0 otherwise. We control for firm fixed effects and time fixed effects. Observations are the numbers of observations. ***,**,* indicates the difference is statistically significant at 1%, 5%, and 10% respective.